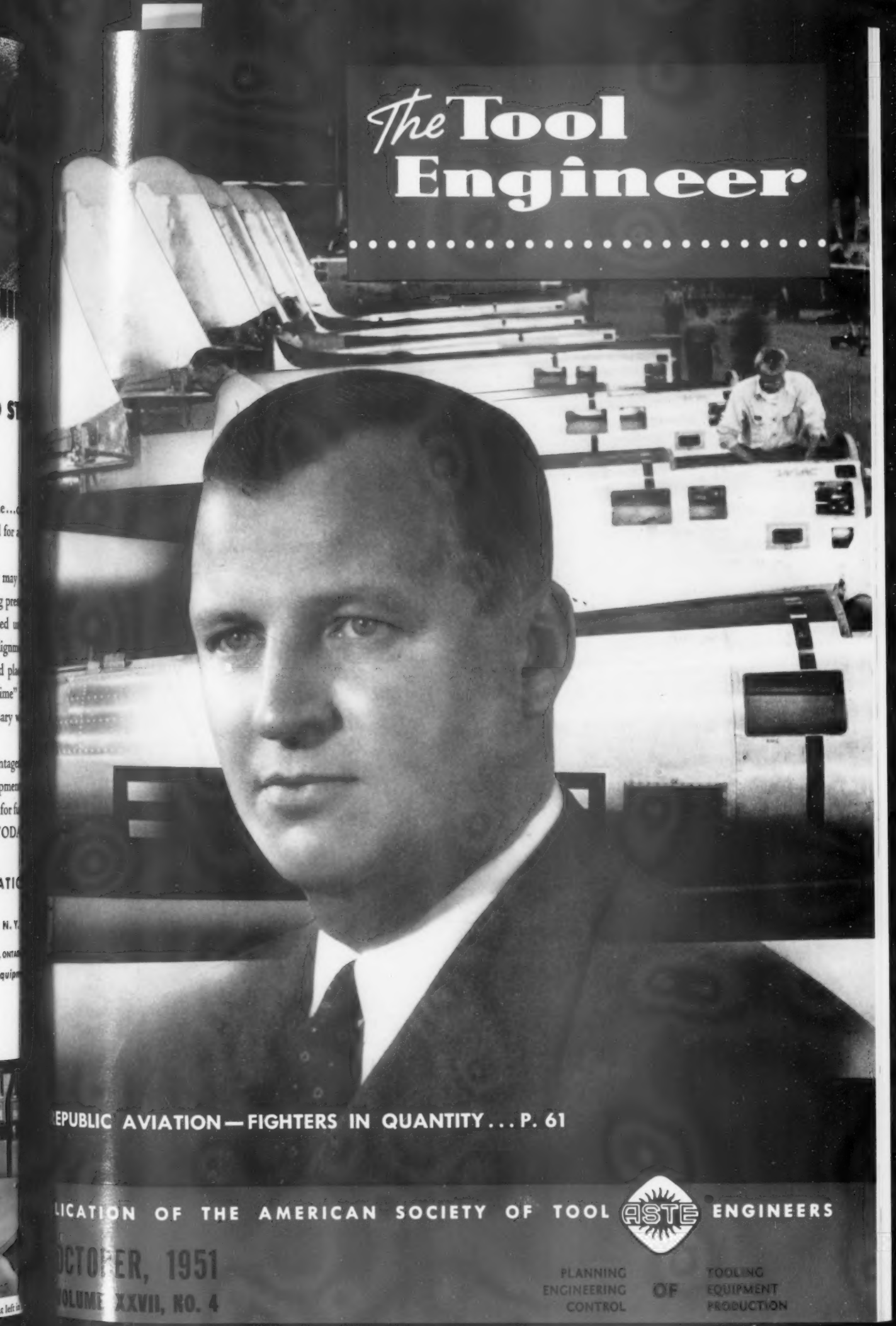


EPUBLIC AVIATION—FIGHTERS IN QUANTITY . . . P. 61

LICATION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS

OCTOBER, 1951
OLUME XXVII, NO. 4

PLANNING
ENGINEERING
CONTROL
OF
TOOLING
EQUIPMENT
PRODUCTION

No wonder he's Happy - - -

HE'S USING PRATT & WHITNEY

MACHINE TOOLS

Jig Borers
Precision Rotary Tables
Vertical Shapers
Toolroom Lathes
Automatic Lathes
Automatic Centering Machines
Thread Millers
Vertical Millers and Profilers
Die Sinkers
Automatic Duplicating Machines
Keller Tracer-Controlled Milling Machines
Cutter and Radius Grinders
Vertical Surface Grinders
Vertical Die and Surface Grinders
Gear Grinders
Deep Hole Drillers
Kellerflex Flexible Shaft Machines
Diaform Wheel Forming Attachment

CUTTING TOOLS

Taps (all types)
Dies (all types)
Screw Plates
Milling Cutters
Metal Slitting Saws
Multiple Thread Milling Cutters
Form Cutters
End Mills
Profiling Cutters
Die Sinking Cutters
Keller Cutters and Tracers
Twist Drills
Deep Hole Drills
Reamers (all types)
Counterbores
Cut-Off Blades
Thread Rolling Dies
Solid Carbide and Carbide Tipped Tools
Kellerflex Burs (Steel and Carbide)

GAGES

Cylindrical Plugs and Rings (Steel and Carbide)
Thread Plugs and Rings (Steel and Carbide)
Pipe Thread Gages (Plugs and Rings)
Snap Gages (AGD Adjustable Limit)
Snap Gages (Roll Thread)
A.P.I. (Oil Country) Gages
A.A.R. (Railroad) Gages
Precision End Measures
Universal Internal Comparators
Hoke and USA Precision Gage Blocks (Steel and Carbide)
Supermicrometers
Standard Measuring Machines
Electro-Mechanical Lead Testers
Electrolimit Comparators
Air-O-Limit Comparators
Tri-Roll Thread Comparators
Continuous (Mill) Gages
Multiple Station Gages
Special Gages

BRANCH OFFICES: Birmingham • Boston • Chicago • Cincinnati
Cleveland • Dallas (The Stanco Co.) • Detroit • Houston (The Stanco Co.)
Los Angeles • New York • Philadelphia • Pittsburgh • Rochester
St. Louis • San Francisco • Export Dept.: West Hartford, Conn.

Any job he tackles turns out right — within the tolerances given on the print. Why? Because he's working with PRATT & WHITNEY Precision Machine Tools, Cutting Tools and Gages. No wonder he's good!

Skilled men, working with precision tools, will turn out better work — faster.

PRATT & WHITNEY

Division NILES-BEMENT-POND COMPANY

WEST HARTFORD 1, CONNECTICUT, U.S.A.

Dedicated to Accuracy for 91 years

LUME XXVII
MBER 4
CTOBER, 1951

The Tool Engineer

Contents

TECHNICAL ARTICLES

A Modern Fable . . . . . By J. J. Demuth 31
Ground Surfaces of High Speed Steel Cutting Tools . . . . . By Vincent O. Stromberg 33
Experimental Measurement of Cutting Forces and Speeds . . . By J. B. Armitage and A. O. Schmidt 36
Centrifugal Steel Casting in Permanent Molds . . . By Jack Osborn Felt 41
Designing for Efficiency: Checking Tapers by the Sine Bar Method . . . . . By John M. Lee 44
Automatic Control of Machine Tools . . . . . By J. M. Delfs 45
State Takes Over Steel . . . . . By Harold Hutchinson 51
High-Production Abrasive Belt Grinding . . . . . By W. A. Papworth 53
Tool Engineering Data 56

TOOL ENGINEERING IN ACTION

Republic Aircraft: Fighters in Quantity . . . . . By Gilbert P. Muir 61

GADGETS

Versatile Fixture Component . . . . . By Robert Mawson 58
Upsetting Die . . . . . By Charles E. Hayward 58
Dog for Odd-Shaped Work . . . . . By Wesley Prince 59
Center Drill Holder . . . . . By Ian J. Peacock 59
Toggle Milling Fixture . . . . . By Paul H. Winter 59
Inspection Gage . . . . . By Anthony Gabriele 60
Redesign for Brake Lever . . . . . By Frank M. Butrick, Jr. 60
To Provide Screw Clearance . . . . . By Cliff Bossman 60

ASTE NEWS

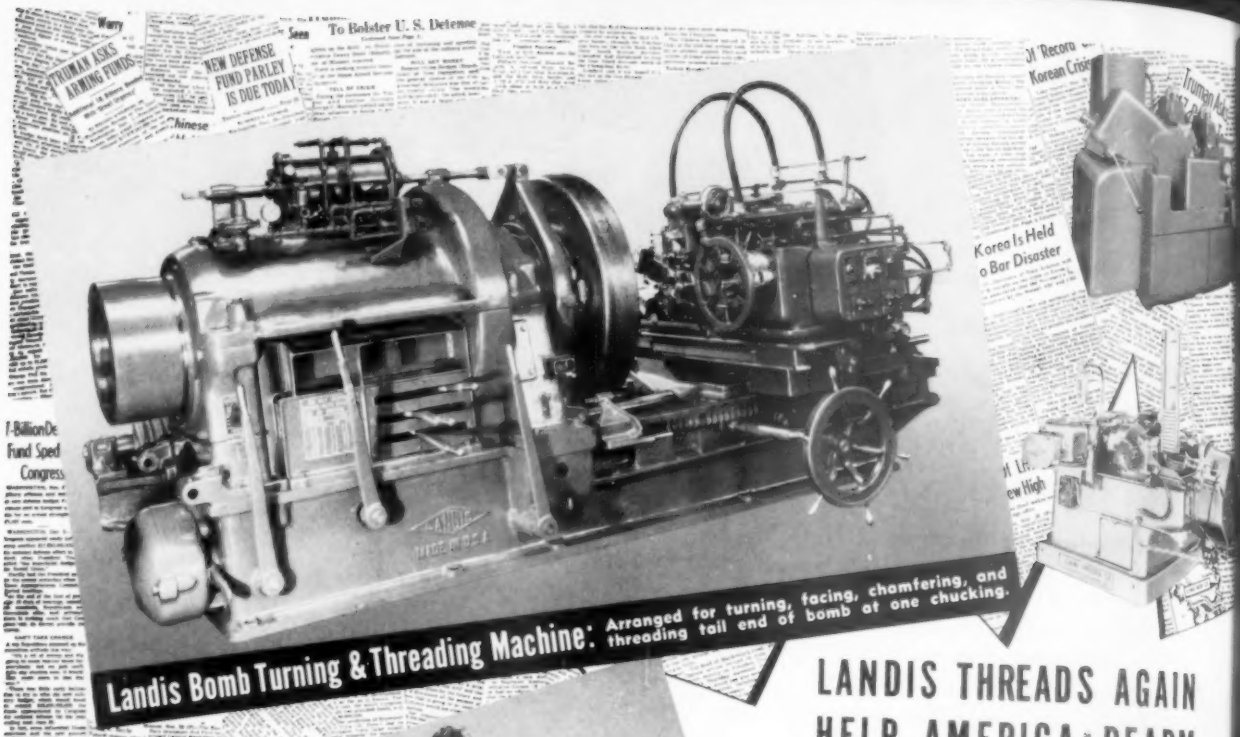
Evansville Invites 2000—Hosts Defense Tooling Program, Semi-Annual Board Meeting . . . . . By Doris B. Pratt 70

DEPARTMENTS

Abstracts of Foreign Technical Literature, 117
Andygrams, 108
Good Reading, 112
Letter from the Editor, 29
News in Metalworking, 83
North, East, West, South in Industry, 110
Technical Shorts, 106
Tools of Today, 85
Trade Literature, 104
Index to Advertisers, 178

AMERICAN SOCIETY OF TOOL ENGINEERS

THE TOOL ENGINEER is published monthly in the interest of the members of the American Society of Tool Engineers. Entered as second-class matter, November 4, 1947, at the post office at Milwaukee, Wisconsin, under the Act of March 3, 1879. Yearly subscription for members, $2.00. Non-members, $6.00. Canada, $6.50; all other countries, $3.00 per year.
Copyright 1951 by the American Society of Tool Engineers.
OFFICE OF PUBLICATION: 239 E. Chicago St., Milwaukee, Wis.
EXECUTIVE AND EDITORIAL OFFICES: 10700 Puritan Ave., Detroit 21, Michigan.



Landis Bomb Turning & Threading Machine: Arranged for turning, facing, chamfering, and threading tail end of bomb at one chucking.

Landmaco Shell Tapper: Type R Shell Tapper tapping the nose end of 75 mm. shells.

The Landmaco Machine: Arranged for threading Garand gun barrels.

LANDIS THREADS AGAIN HELP AMERICA * REARM

Threads produced by the various types of Landis Threading Equipment are again important in the operation of war matériel. Hundreds of Threading Machines, thousands of Die Heads and Taps, hundreds of thousands of sets of Landis Chasers were supplied to manufacturers of war matériel during World War II. It was once estimated that enough Landis Taps were in use to thread 20,000,000 shells a month.

Illustrated on the left are three important wartime adaptations — but all Landis Threading Equipment can do an outstanding defense production job. Necessary adaptations, either in equipment or process, are developed by our Engineering Department from the wealth of experience gained during World War II. Write for further information.

LANDIS Machine COMPANY

WAYNESBORO, PENNSYLVANIA, U. S. A.

Represented in the Domestic Oil Fields by: Colcord-Wright Machinery & Supply Co., St. Louis, Mo.; C. J. Harter Machinery, Houston, Texas; Frederic Baker Co., New Orleans, La.; Moore Machinery Co., Los Angeles and San Francisco, Calif.; Hendrie & Bolthoff Mfg. & Supply Co., Denver, Colo.

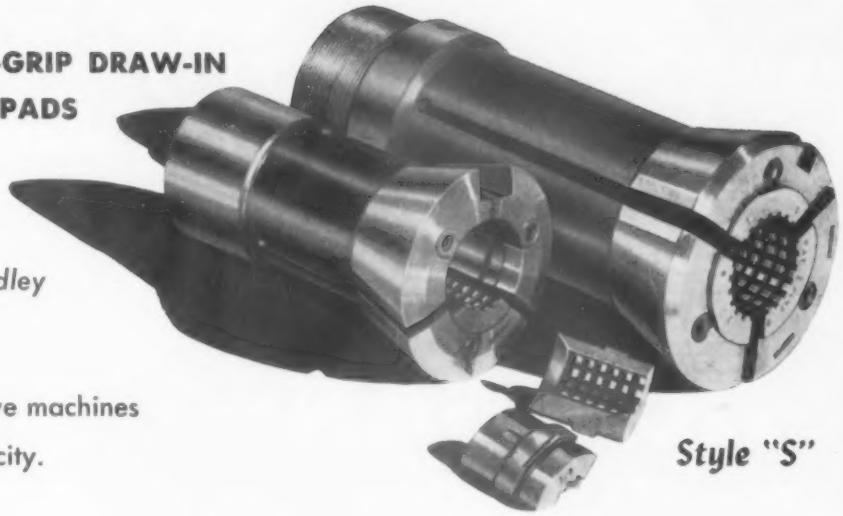
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-2

HARDINGE ELMIRA N.Y.

STYLE "S" SURE-GRIP DRAW-IN MASTER COLLETS and PADS

Cleveland
Cone
Greenlee
Gridley and Acme-Gridley
National Acme
New Britain

Available for all sizes of above machines up to and including 3½" capacity.



Style "S"

HARDINGE ELMIRA. N.Y. *Masters and Pads* *for* BETTER PERFORMANCE *and* BETTER PRODUCTION

HARDINGE ELMIRA. N.Y.

STYLE "B"

MASTER FEED FINGERS and PADS

Brown & Sharpe
Cleveland
Cone
Davenport
Greenlee
Gridley and Acme-Gridley
National Acme
New Britain

Available for all sizes of above machines up to and including 3½" capacity.

Style "B"

Ask for Style "S" and Style "B" Bulletins which give all performance features, price savings, and ordering information.

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

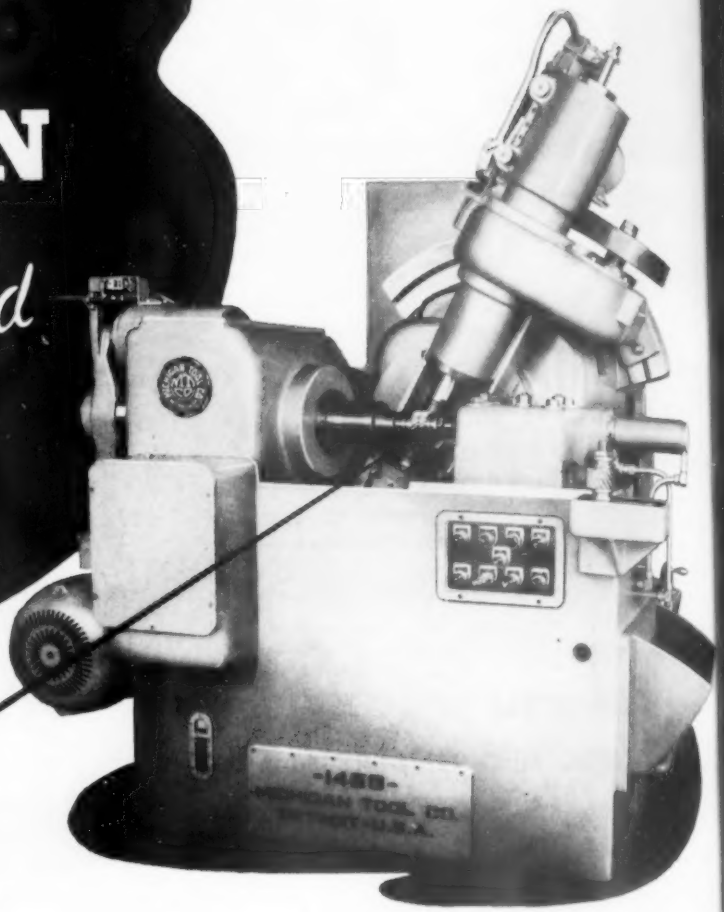
"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

Announcing

THE NEW MICHIGAN

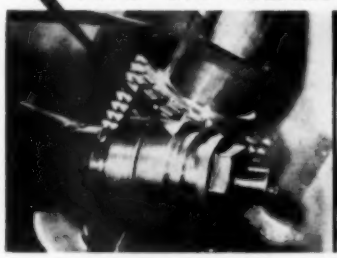
High Production High Speed

GEAR HOBBER



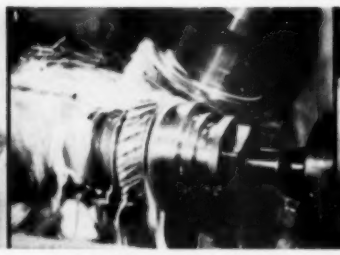
for
SPUR AND HELICAL GEARS AND SPLINES
up to 8" diam. and 5" face width

READY TO HOB TWO 3⅛" GEARS



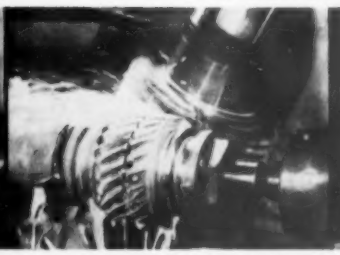
Just before button is pushed to start the cycle.

15 SECONDS LATER



Hob has completed its plunge cut and transverse feed of work starts.

. . . AT 37 SECONDS



Nearing the end of the climb cut.

FINISHED IN 58 SECONDS

Ready for reloading.

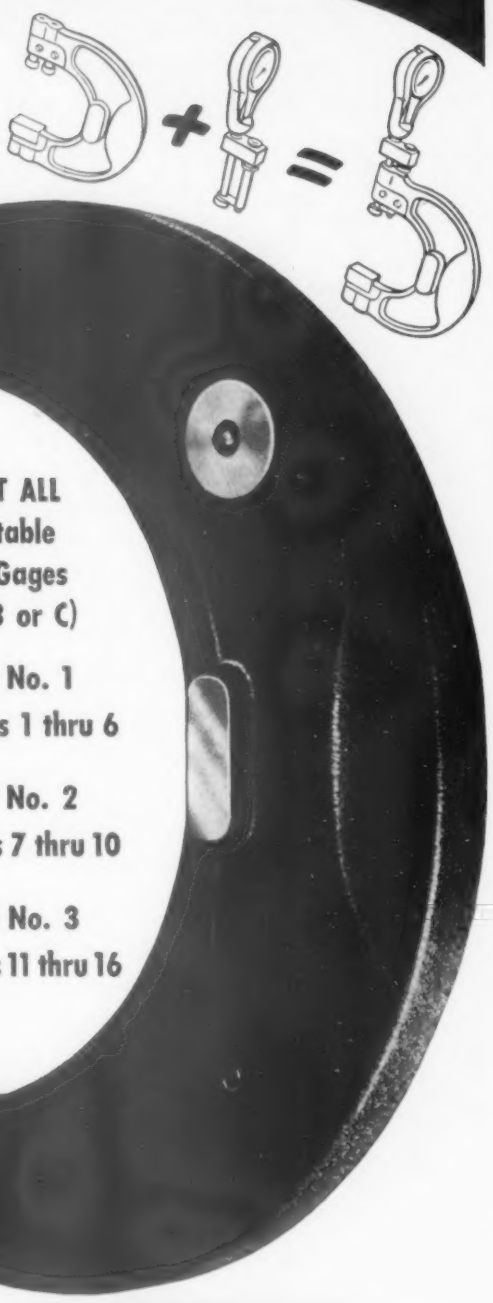
Write today for Announcement Bulletin No. 1458A

MICHIGAN TOOL Company

7171 E. McNICHOLS RD. • DETROIT 12, MICHIGAN, U.S.A.

Your AGD Adjustable Limit Snap Gage becomes an *Indicating DIAL* Snap Gage

WITH THE STANDARD *Dializer**



ES . . . by simply fitting STANDARD *Dializers* to our present AGD Adjustable Limit Snap Gages (Models A, B or C) you can convert them to Dial Indicator Snap Gages!

You will gain all the advantages of indicating instruments at considerable saving in cost!

DIALIZER easily installed or transferred from one frame to another.

RANGE OF ADJUSTMENT of gage is unaffected.

ACCURACY ASSURED by double reed principle.

INDICATOR furnished with either .0001" or .001" graduations.

SIZES TO FIT ALL AGD Adjustable Limit Snap Gages (Models A, B or C)

***Dializer* No. 1**
Fits AGD Frames 1 thru 6

***Dializer* No. 2**
Fits AGD Frames 7 thru 10

***Dializer* No. 3**
Fits AGD Frames 11 thru 16

POPULAR ACCEPTANCE

Repeat orders are good evidence of practicality and tested-in-use value. Write for prices. Be sure to specify size and quantity.

*Patent Applied For

STANDARD GAGE CO., Inc., *Poughkeepsie, N.Y.*

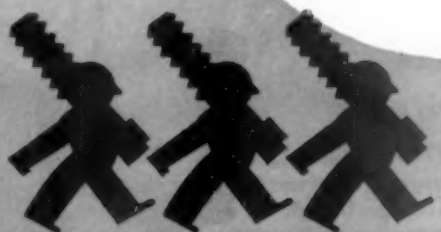
WINTER BALANCED ACTION

HAND TAPS

UNIFORMLY ACCURATE TAPPED HOLES are easily attained when you specify Winter "Balanced Action" Taps. Among other factors, accuracy of spacing and concentricity of chamfers assure this. Infinite care is taken to see that all cutting edges are truly concentric with the axis of the tap, of the same shape, and of equal spacing. The complete Winter line includes chip driver, hand, machine screw, pipe, nut, tapper, and pulley taps. They are stocked by distributors near you and at factory branches in New York, Detroit, Chicago, and San Francisco. WINTER BROTHERS COMPANY, Division of the National Twist Drill and Tool Co., Rochester, Mich., U. S. A.

ALWAYS AT YOUR SERVICE

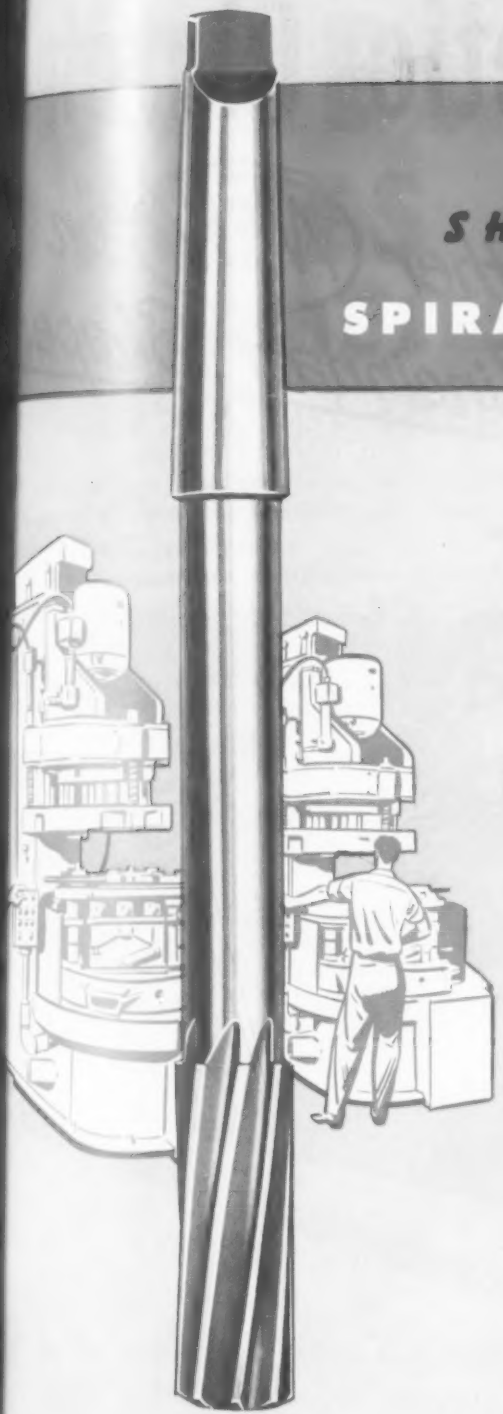
YOUR LOCAL DISTRIBUTOR carries a complete stock of WINTER Taps on his shelves—as close to your tapping problems as the telephone on your desk.



WINTER BROTHERS COMPANY

WINTER

NATIONAL
SHEARING ACTION
SPIRAL FLUTED REAMERS



REAMING WITHOUT CHATTER

in deep, small diameter holes is easy when you use National "Shearing Action" Spiral Fluted Reamers. As with all reamers bearing the National name, you can be sure of smooth finish and exact tolerances. "Shearing Action" is a plus value you get in National cutting tools. The complete line includes reamers, end mills, twist drills, milling cutters, counterbores, hobs, and special tools. They are stocked conveniently near you at factory branches in New York, Chicago, Detroit, Cleveland, and San Francisco. NATIONAL TWIST DRILL AND TOOL COMPANY, Rochester, Michigan, U. S. A.

"CALL YOUR DISTRIBUTOR"

It is National's firm belief, based on long experience, that the local industrial distributor is the one best source for all staple industrial needs—including NATIONAL Metal Cutting Tools.

NATIONAL TWIST DRILL & TOOL ROCHESTER, MICH., U.S.A.

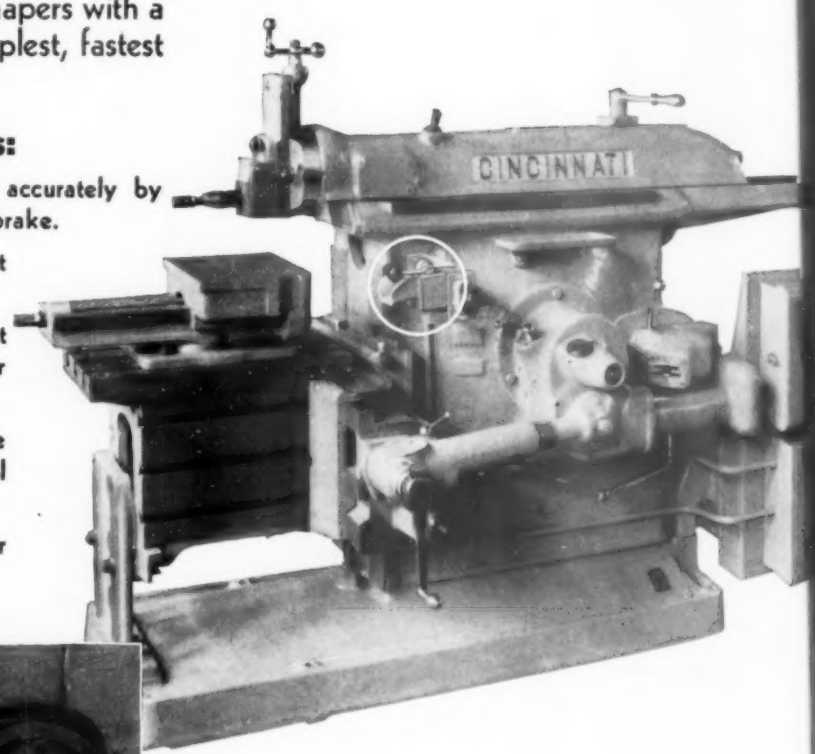
National

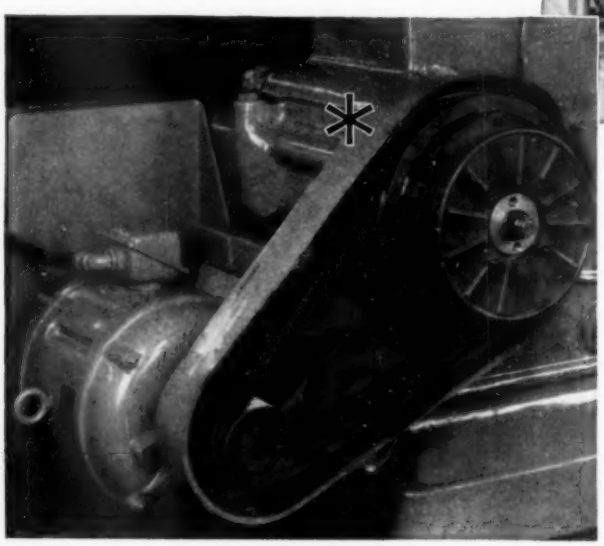
* Electro-Magnetic Clutch and Brake – another NEW on Cincinnati Shapers

Now, with one convenient control the new electro-magnetic clutch and brake start and stop Cincinnati Shapers with a finger touch. It is the simplest, fastest control on any shaper.

Important advantages:

1. Ram is positioned quickly, accurately by instant action of clutch and brake.
2. Starting and stopping by just a light touch.
3. The single control lever is at the most convenient operator position.
4. Clutch and brake operate without grab . . . are powerful and smooth in action.
5. No adjustment of clutch or brake is required.





This clutch and brake are standard on all new Cincinnati Shapers. They are Warner units which have been thoroughly proven on machine tools.

Write for complete Cincinnati Shaper Catalog N-5

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO U.S.A.

SHAPERS · SHEARS · BRAKES

HOLES
HOLES
and more HOLES
1500 of them

To be sure, this may be an unusual job. However, it proved the flexibility and practicability of the Bullard Spacer.

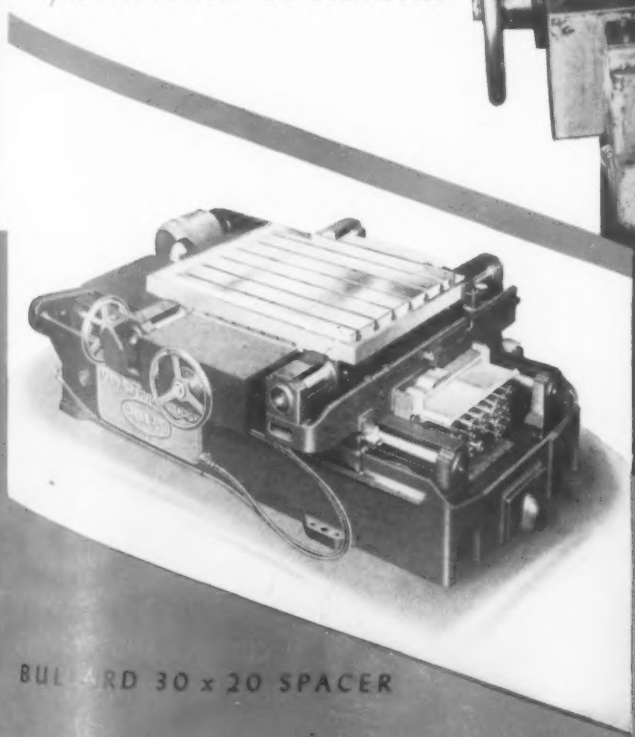
It required several combination of settings between the work location on the table and the drill saddle and arm.

However, the actual set-up and machining time figured 5-½ hours for the Spacer instead of 11-½ by the best previous method.

This case study illustrates the possibilities and wide application of the Bullard Spacer.

Here is a machine for spotting, drilling, counterboring, reaming, or tapping—without jigs.

Ask Bullard Engineers how your Jig Costs and problems can be reduced.



BULLARD 30 x 20 SPACER

THE
BULLARD
COMPANY
BRIDGEPORT 2, CONN.

Instrumen
PHOTO COURTESY ARMA CORPORATION
GEAR SHAPE
SHAVING MACHIN
THREAD GENERATO
CUTTERS AND SHAVING TOO
GEAR INSPECTION INSTRUMEN
PLASTICS MOLDING MACHIN

ear Making

elies on the *Fellows* Method

ARMA INSTRUMENT

FORD

FAIRCHILD CAMERA AND INSTRUMENT CORPORATION

Bendix AVIATION CORPORATION

HUGHES

AMERICAN BOSCH

Holding production to exceptionally close tolerances is a marvelous team accomplishment

The details are 'top secret' Each maker here represented is a specialist in his own right. The technical supremacy of our civil *and* military aviation, our guided missile and other developments, is directly augmented by the inventiveness of all our instrument makers and the excellence of their manufacturing techniques.

Where gears are concerned, the skill of shop experts combined with Fellows precision equipment achieves exceptional accuracy on a commercial basis. For fine-pitch gears, Fellows 3-Inch Fine-Pitch Gear Shapers, Shaving Machines, Red Liners, and other inspection equipment, present an unbeatable combination.

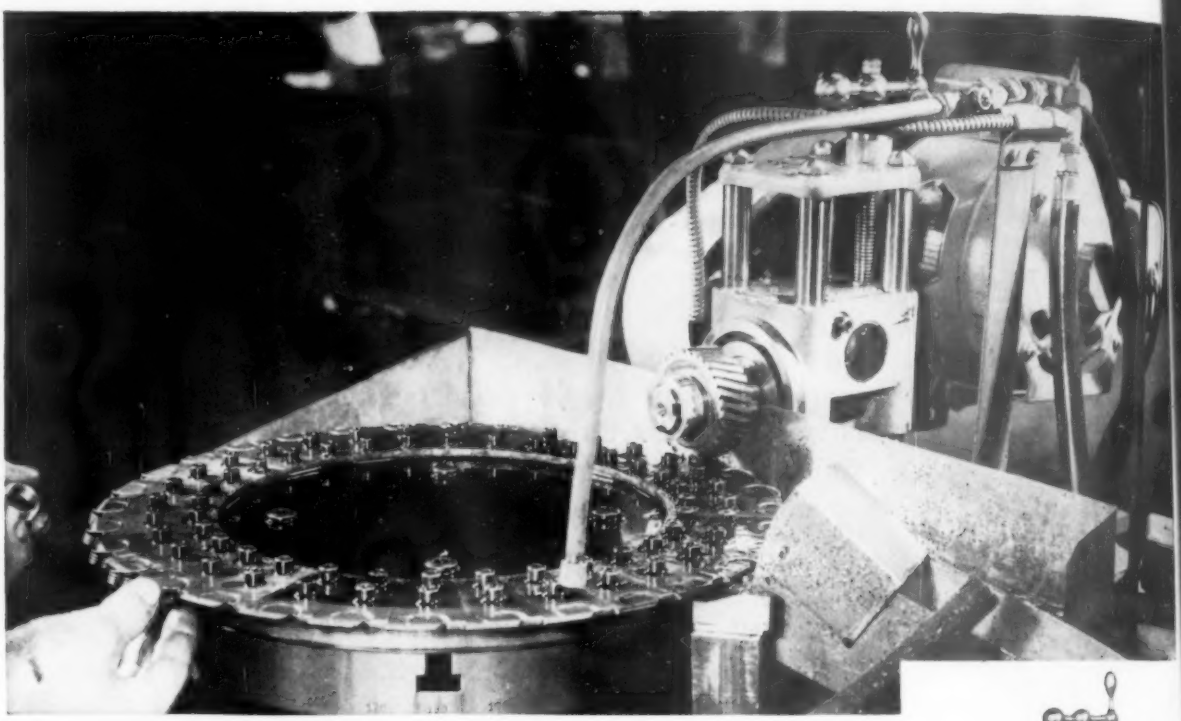
Fellows Experts are constantly available to discuss costs and the Fellows Method of fine-pitch gear production. Catalog literature is yours for the asking.

Fellows

THE FELLOWS GEAR SHAPER COMPANY · Head Office and Export Department · 78 River Street, Springfield, Vermont
Branch Offices: 616 Fisher Bldg., Detroit 2 · 5835 West North Avenue, Chicago 39 · 2206 Empire State Bldg., New York 1

PRODUCTION INCREASE···150%

Continuous Miller...made from readily available parts...helps Heli-Coil step up output

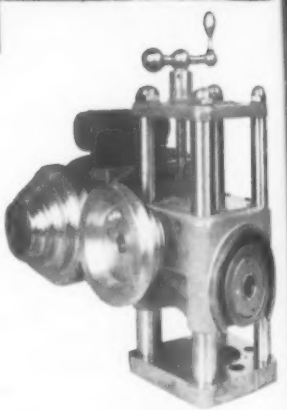


A VERSA-MIL BASIC UNIT, mounted on frame of a discarded drill press, combined with motorized rotary table and work-holding plate, makes a continuous miller for squaring ends of thread inserts for Heli-Coil Corporation. Number of pieces per hour, 2½ times that obtained from #1 Miller previously used.

VERSA-MIL may also provide you with an immediate, low-cost solution to many of your machining problems. You need not wait for additional new machine tools.

VERSA-MIL is a rugged, direct-powered tool, built to machine tool precision standards. It may be combined with machine tools you now have to provide a wide range of additional functions; milling, drilling, boring and grinding, at spindle speeds from 44 to 18,000 rpm.

Our new 24-page Bulletin # 6, containing specifications and capacities, and illustrating typical uses, may ease machine tool difficulties for you. You may have your copy by writing to VERSA-MIL, 30 Church Street, New York 7, N.Y.



BASIC UNIT mills, drills and bores at spindle speeds from 44 to 450 rpm. 2 sizes, capacity up to 1" keyway 1½" per minute in mild steel. Accessory heads add higher speeds and wide range of angular positions.

Get EXTRA MACHINE TOOL CAPACITY with

VERSA-MIL

Trade Mark

The Tool for Precision Milling, Boring and Grinding

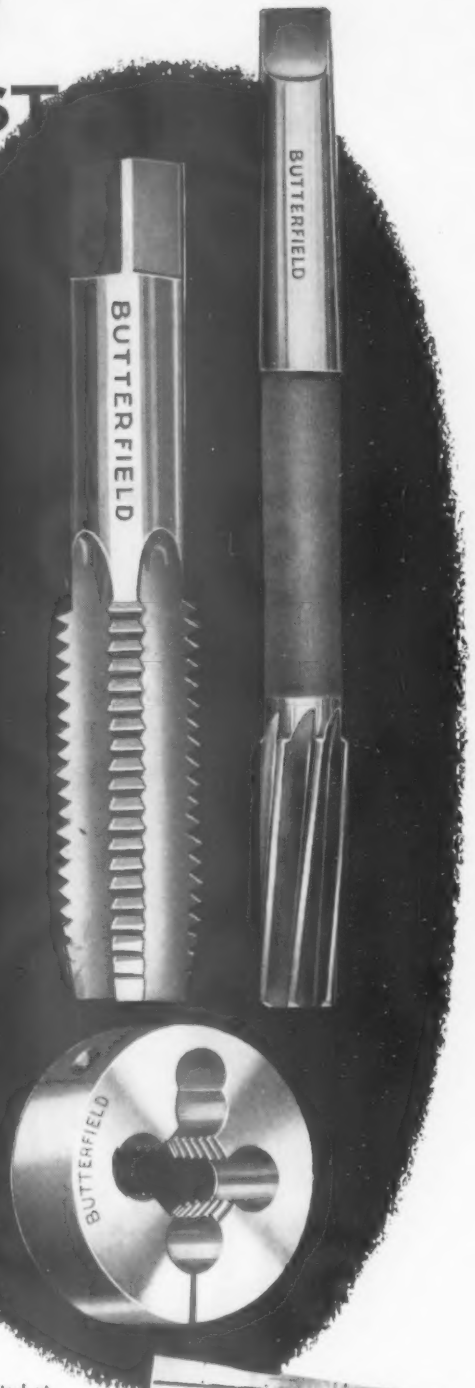
TO INSURE LOW CUTTING TOOL COST

1 Be sure of uniformity

2 Be sure of top performance

3 Be sure of 100% inspection — each tool individually inspected

4 Be sure they're Butterfield ... the tools that meet all three specifications



BAR STOCK is here tested at Butterfield for microstructure.

A complete line
for all types of applications.
Made in high speed or carbon steel
for best results on every job.

See Your Nearby Butterfield Distributor For Prompt Deliveries and Service

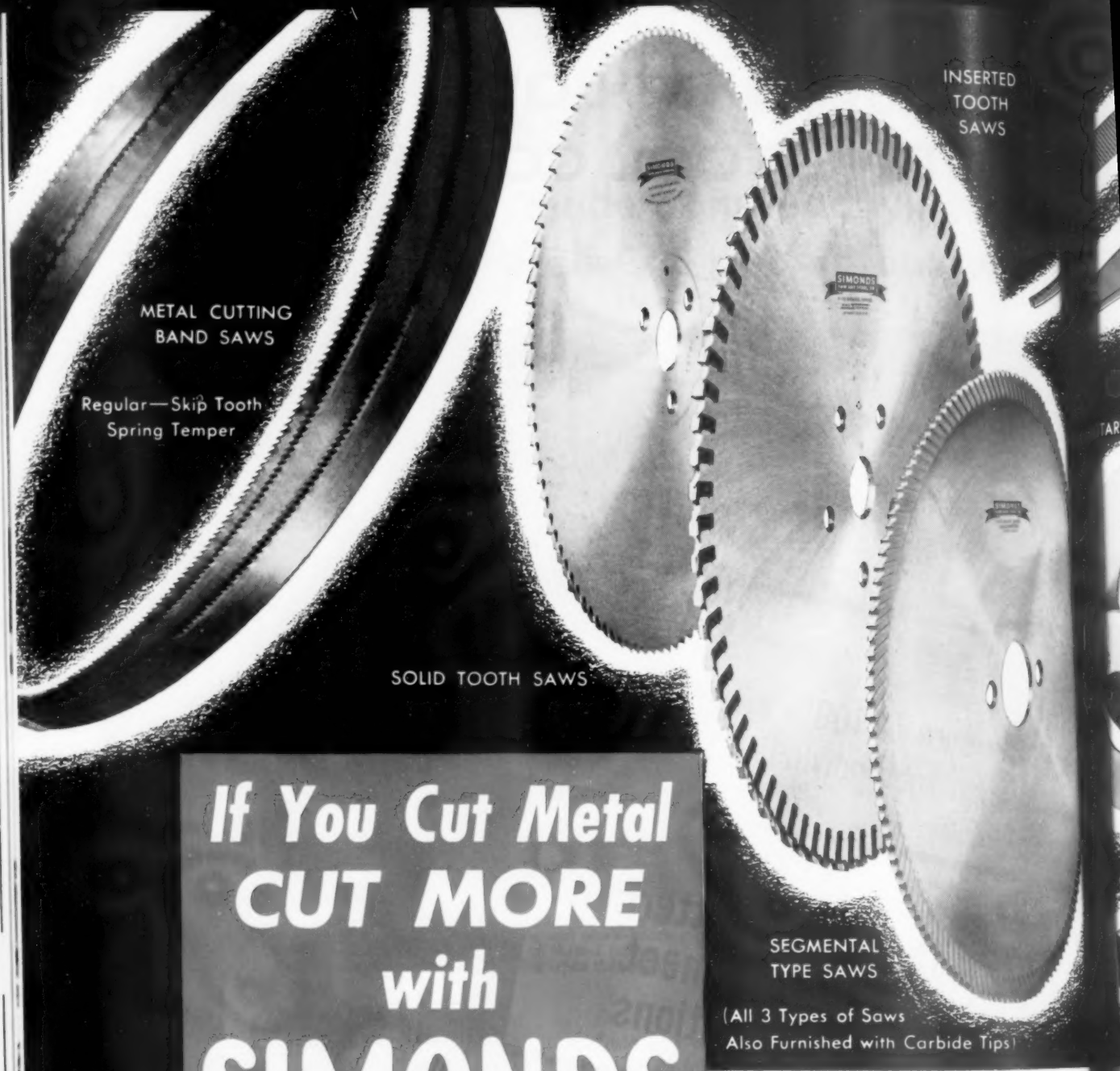
Union Twist Drill Company
BUTTERFIELD DIVISION
Derby Line, Vermont
In Canada: Rock Island, Quebec

BUTTERFIELD

THE 100% INSPECTED TOOLS

Every Tool Individually Inspected

TAPS • DIES • REAMERS • SCREW PLATES



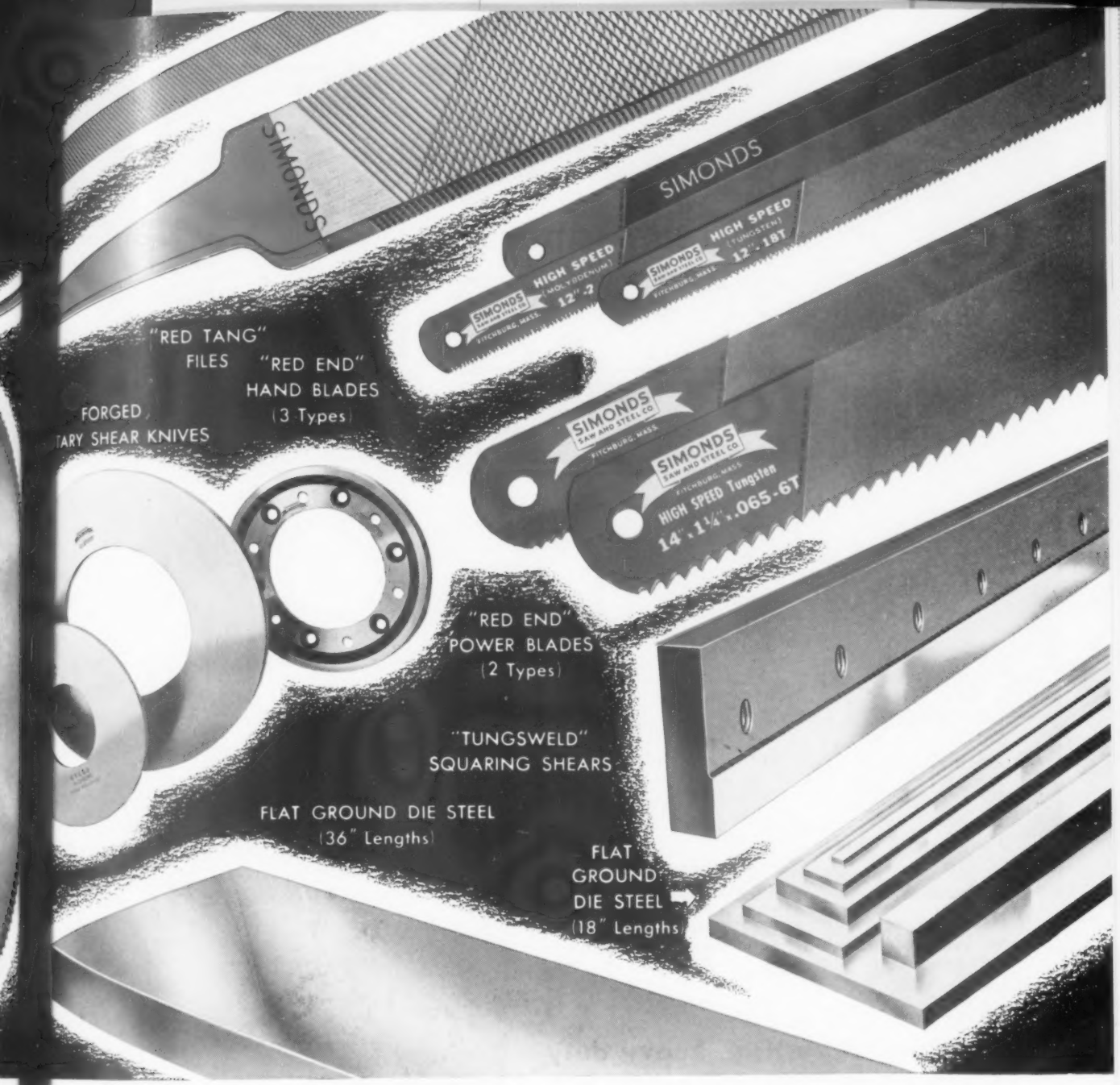
If You Cut Metal CUT MORE with SIMONDS Industrial Line

Over 100 years devoted
ideal of developing the fu
line of cutting tools in this c
. . . that's what underwrites
purchase you make of any p
in the Simonds Line.

And don't forget this: Y
100% Simonds Quality Con
beginning with steels proce
your job from Simonds own ste
. . . and going all the way th
Simonds famous Windowless
(first in this country).

Here, in this completely
trolled-conditions plant, m
straight-line production meth

The Simonds Line is


SIMONDS
SIMONDS
HIGH SPEED (MOLYBDENUM) 12" .2
SIMONDS
HIGH SPEED (TUNGSTEN) 12" .18T
"RED TANG" FILES
"RED END" HAND BLADES (3 Types)
FORGED
TARY SHEAR KNIVES
SIMONDS SAW AND STEEL CO.
SIMONDS SAW AND STEEL CO.
HIGH SPEED Tungsten 14" x 1¼" x .065-6T
"RED END" POWER BLADES (2 Types)
"TUNGSWELD" SQUARING SHEARS
FLAT GROUND DIE STEEL (36" Lengths)
FLAT GROUND DIE STEEL (18" Lengths)

mented by special equipment
duce cutting tools of *one qual-*
. . . Simonds TOP Quality.
you can bank on it that
Simonds Tools will deliver
erformance on *any* job . . .
hand filing and hacksawing,
duction machine cutting with
of all types and sizes. So, if
st and high-level production
tal to you . . . then specify
nds" to your distributor or
on any requirement you may
on which the tools shown
will serve.
member: *You start to save, the*
you say SIMONDS!

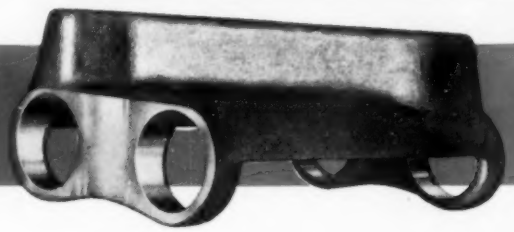
SIMONDS SAW AND STEEL CO.

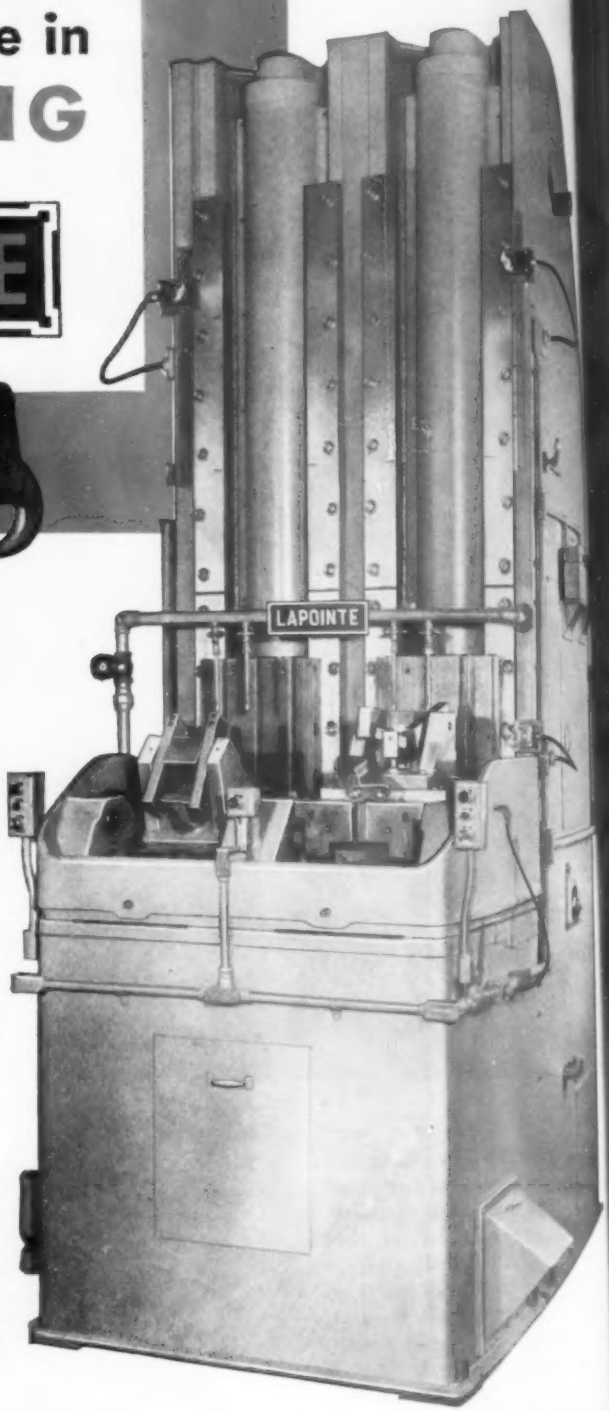
FITCHBURG, MASS.

Branch Offices in Boston, Chicago, San Francisco and Portland, Ore. Canadian Factory in Montreal, Que.

the Production Line

The biggest name in BROACHING ...is LAPOINTE





LAPOINTE'S name is big because it's the world's *oldest* manufacturer of broaches and broaching machines . . .

Because it's also the world's *largest* . . .

Because its engineering facilities and production know-how are unequalled . . .

Because it takes responsibility for the complete job: machines, tools, and fixtures . . .

Because it represents the accumulation of nearly 50 years of broaching experience . . . designing, building, and tooling such machines as this LAPOINTE

25 ton, 66-inch stroke

Double ram vertical, heavy duty

BROACHING MACHINE

with fixtures that automatically centralize and hydraulically clamp; electrically interlocked with the ram of the machine.

Simple to operate, simple to load and unload. That's why this machine has such a high production rate, even for relatively large parts. Shown here, it is broaching tank track link shoes from a chrome vanadium forging, at a speed of 200 parts per hour — at 85% efficiency!

You can learn more about LAPOINTE Double Ram Vertical Broaching Machines if you write today for Bulletin DRV-5.

THE *Lapointe* MACHINE TOOL COMPANY

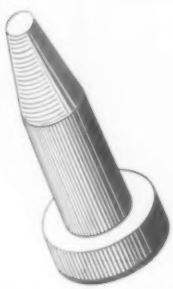
HUDSON, MASSACHUSETTS • U. S. A.

Branch Factory: Watford, Herts., England

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHES AND BROACHING MACHINES

PRODUCTION ON CENTERLESS GRINDER

multiplied 5 times per wheel-dressing



Cotter-pin bridge rivets were centerless-ground with Robertson wheels on Cincinnati No. 2 centerless grinders like the one shown in the photograph above.

How to increase production is a matter of vital import in every plant in the country. Here's how one manufacturer licked the problem:

He had the job of manufacturing cotter-pin rivets for temporary bridge structures. In grinding these from drop forging, he was getting only 25 rivets per wheel-dressing, taking off 1/16" stock on a plunge cut. This was not fast enough.

A Robertson engineer was called in, and, after studying the problem, recommended a Robertson SA54-QV wheel. Production was increased to 125 rivets per wheel-dressing—an increase of 400 percent.

Whether you are working on steels of various analysis and hardness, on other metals, such as cast iron, brass, bronze, aluminum or on materials like Steatite or plastics, Robertson grinding wheels are designed to give you a combination of high production, quality finish and low cost.

One reason why a Robertson wheel was so successful in this application, as it has been in many others, is that we knew firsthand all the details of this manufacturer's problem. We were able, therefore, to give him a wheel of the proper grain and grade to do the job and do it right.

Be sure to blueprint the full details of your problem when writing, and you will be sure to get a wheel that gives you a substantial bonus in production time.

ROBERTSON MANUFACTURING CO.
TRENTON 5, NEW JERSEY

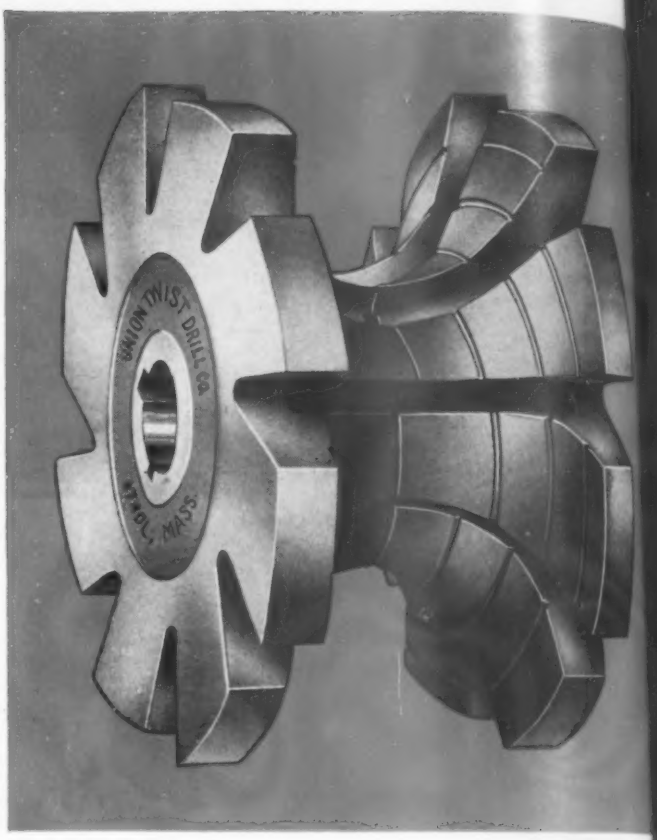
RESIN-BONDED AND VITRIFIED-BONDED GRINDING WHEELS • MOUNTED WHEELS • SEGMENTS

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-17

You get more duplicate parts... with

UNION

Form Cutters



MADE OF HIGH SPEED STEEL, Union form cutters are designed to cut with high accuracy within commercial limits. Where even greater accuracy is required, we are prepared to grind form cutters to much closer limits.

UNION FORM CUTTERS, as the name implies, are made to a certain outline or shape, for the production of parts which shall be duplicates, regardless of the number produced. Since they are ground on the face of the tooth, their form remains unchanged by repeated sharpening — when properly done — so that every piece milled during the life of the cutter will be a duplicate. And since, like all Union tools they are built to give extra-long service life, you'll find that Union form cutters are your surest bets for maximum production of duplicate parts with a single cutter — and for greatly reducing milling expenses in this type of operation.

FORM AND PROFILE CUTTERS IN GANGS

Many pieces now machined in successive stages may be more economically handled in one operation, using the proper gang of form cutters. Or, form cutters may be combined with plain mills, side mills and half side mills to finish the work in one set-up. We will be glad to suggest the proper assembly of cutters on receipt of your blueprint.

no other form cutter will outperform a **UNION**

contact your local distributor

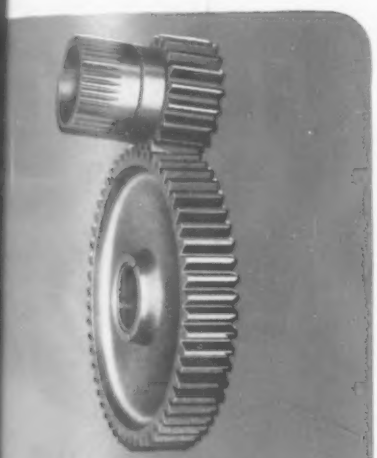
His name is listed in Union's THOMAS' REGISTER insert under "Drills, Twist".

UNION TWIST DRILL COMPANY, ATHOL, MASSACHUSETTS

Milling Cutters · Gear Cutters · Twist Drills · Hobs · Reamers · Carbide Tools

We own and operate S. W. CARD MANUFACTURING CO. Division, Mansfield, Mass. Taps, Dies, Screw Plates . . . BUTTERFIELD DIVISION, Derby Line, Vt., Taps, Dies, Screw Plates, Reamers . . . BUTTERFIELD DIVISION, Rock Island, Que., Milling Cutters, Twist Drills, Hobs, Reamers, Taps, Dies, Screw Plates.

BASIC FACTS ON GEAR TOOTH CROWNING



End Bearing

Elliptoid Tooth Form

Q. Why are gear teeth given the Elliptoid tooth form or crowned?

A. To PREVENT "end bearing" in service.

Q. What is "end bearing"?

A. A concentration of load at the end of the tooth due to end contact between teeth rather than its distribution along the entire tooth face —the condition for which the tooth was designed.

Q. Why is "end bearing" objectionable?

A. Because it imposes concentrated stresses beyond the fatigue strength of the material at the contact point which may lead to premature failure. It is also an important cause of noisy gear operation.

Q. What is gear tooth crowning?

A. A calculated elliptical reduction in tooth thickness from the point of maximum crown (usually the center) toward both ends. Normally it amounts to .0003″ per inch of face width per side, but this is optional depending on service conditions.

Q. Can "end bearing" be avoided by any other method?

A. No. Because

1. It is practically impossible to assure perfect alignment under all conditions of loading due to unavoidable deflections in shafts, bearings and the mountings, all of which are elastic.

2. It is also impracticable to avoid all fire distortion in hardening gears which have been machined previously.

Q. How are gear teeth crowned?

A. On Red Ring Shaving Machines.

Q. Can the amount of crown be controlled accurately?

A. Positively. Such a large number of leading automotive gear plants would not be using it otherwise.

Crowning is controlled on the Model GCI Shaving Machine by locking the cam which actuates the table movement at the desired point. Models GCU and GCV use formed cutters ground precisely to the amount of crown required. No variation is possible without changing cutters.

In a random check of 4000, 1″ face gears the maximum variation in the amount of crown was within the specified tolerance of .0002″.

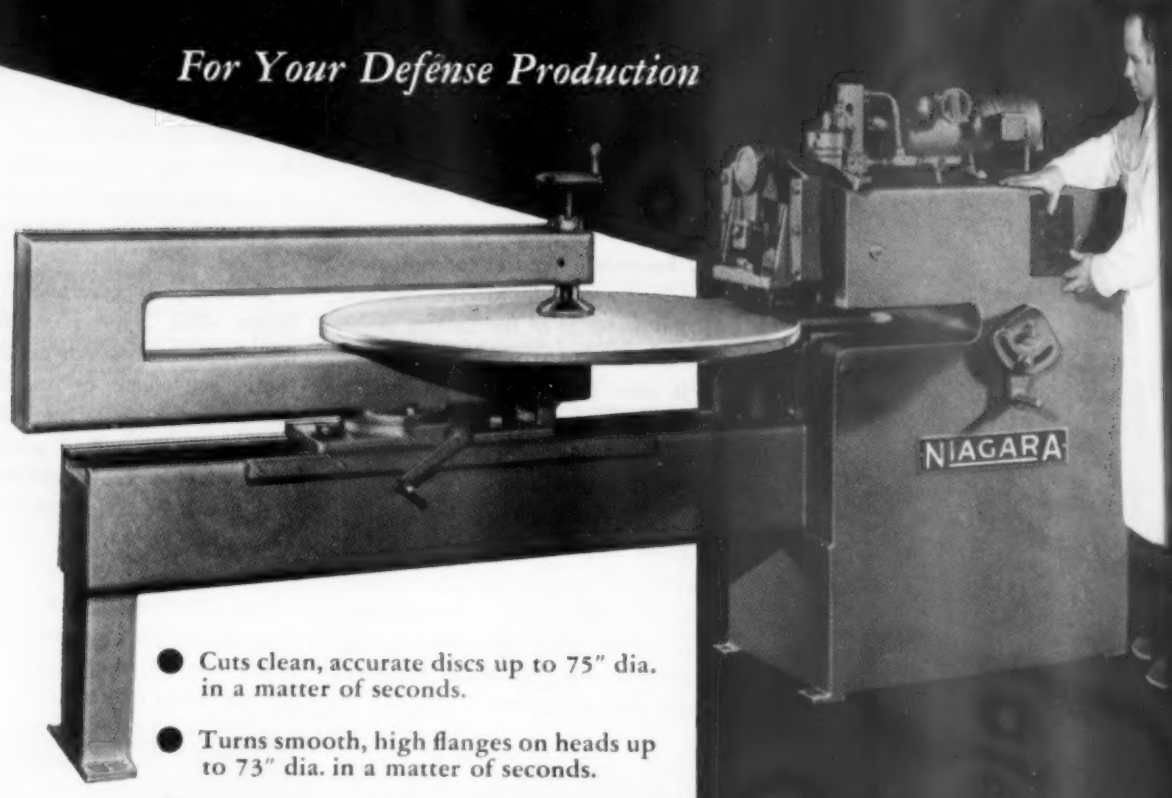
Write for
BULLETIN S49-5
for a more detailed discussion of gear tooth crowning.

NATIONAL BROACH & MACHINE CO.
5600 ST. JEAN . . . . . DETROIT 13, MICHIGAN
WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

NIAGARA

ANNOUNCES A NEW Model 8-8 Hi-Production CIRCLE SHEAR AND FLANGER

For Your Defense Production



- Cuts clean, accurate discs up to 75" dia. in a matter of seconds.
- Turns smooth, high flanges on heads up to 73" dia. in a matter of seconds.
- Capacity up to 8 ga. mild steel, 12 ga. stainless steel.
- Minimum investment in machine and tools for hi-production of a vast size range of discs and heads.
- Fast set up for either circle shearing or flanging operation.

- Ideally adapted for either high or lo and even single quantity production.
- Effortless push button control with ne automatic feeding cycle.
- Variable Speed Power Flanging Feed lowers and raises upper flanging roll optimum speed for ideal flanging. Operator can dial to proper feed rate to suit thickness of material.
- Unbreakable steel construction throughout.

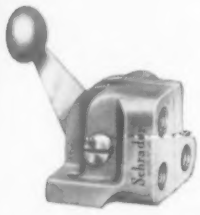
Write for Bulletin 86

NIAGARA MACHINE & TOOL WORKS • BUFFALO 11, NEW YO

Manufacturers of America's Most Complete Line of Presses, Shears, Machines and Tools for Plate and Sheet Metal Work

Schrader Valves—practical answers to air control problems

Way Valve—This inexpensive valve ive long service and is designed to le small bore single acting cylinders as the Schrader ClampAir. The stain- steel lever is functionally designed for e stops and facilitates comfortable operation. A small hole in the lever des means for mechanical operation ired.

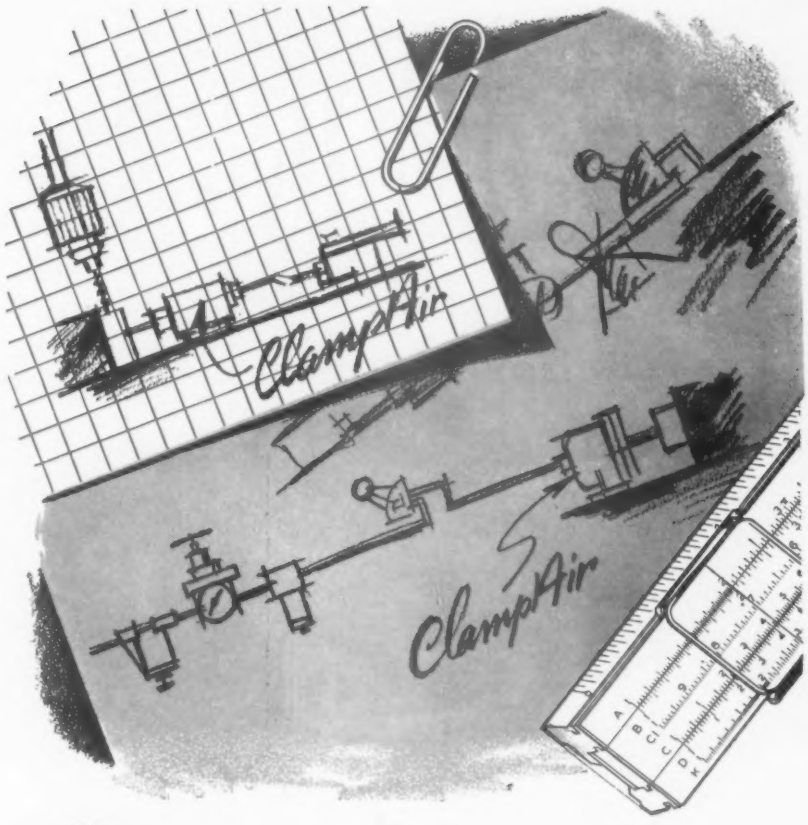


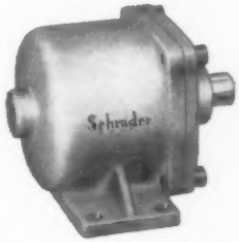
ves With Hand Lever (Two, Three and Four-Way Types) Durability and simplicity construction feature these forged brass es which are designed for easy hand ration. One hardened steel bolt holds two-piece body and internal parts in ce and contributes to time-saving, low- maintenance.

lves With Mechanical Lever (Two, Three d Four-Way Types) This type valve is ilar to the one described above but has ever arranged for mechanical actuation provide automatic operation. The rugged el lever will stand up under rapid actua- n over long periods of use.

r Cylinders • Operating Valves • ss & Shear Controls • Air Ejec- n Sets • Blow Guns • Air Line uplers • Air Hose & Fittings • se Reels • Pressure Regulators & ers • Air Strainers • Hydraulic auges • Uniflare Tube Fittings

Schrader
PRODUCTS
CONTROL THE AIR





ClampAIR cylinders can simplify any work holding operation

You can eliminate the tiring muscular work of setting mechanical clamps, as well as reduce the time for clamping with the new Schrader ClampAir.

It is actually a bantam-size air cylinder, with sufficient power to hold the work firmly in place for as long as you want . . . with the same force every time. Once you start using the Schrader ClampAir for your holding operations, not only will your productions be increased but rejects will be fewer.

Various types of machines, such as Drill Presses, Milling Machines, Gluing Devices and many others, are natural locations for Schrader ClampAirs. Moreover, since they are basically push type cylinders, they can be used in many mechanisms to furnish a short, sturdy push stroke. They are available in either end or side mounting, and a variety of bore diameters and stroke lengths.

Look over your shop and note the many places where Schrader ClampAirs will help you do jobs faster and safer—without fatigue...or, submit your problem to us. We will be glad to help you determine what will best fit your needs. Send us a letter outlining your particular installation, your idea, or fill out the coupon below.

Mail this Coupon Today

A. Schrader's Son
Division of Scovill Manufacturing Company, Incorporated
462 Vanderbilt Avenue, Brooklyn 6, N. Y., Dept H-5

Please send me further information on the Schrader ClampAir and valves.

Name_____ Title_____

Company_____

Address_____

City_____ Zone___ State_____

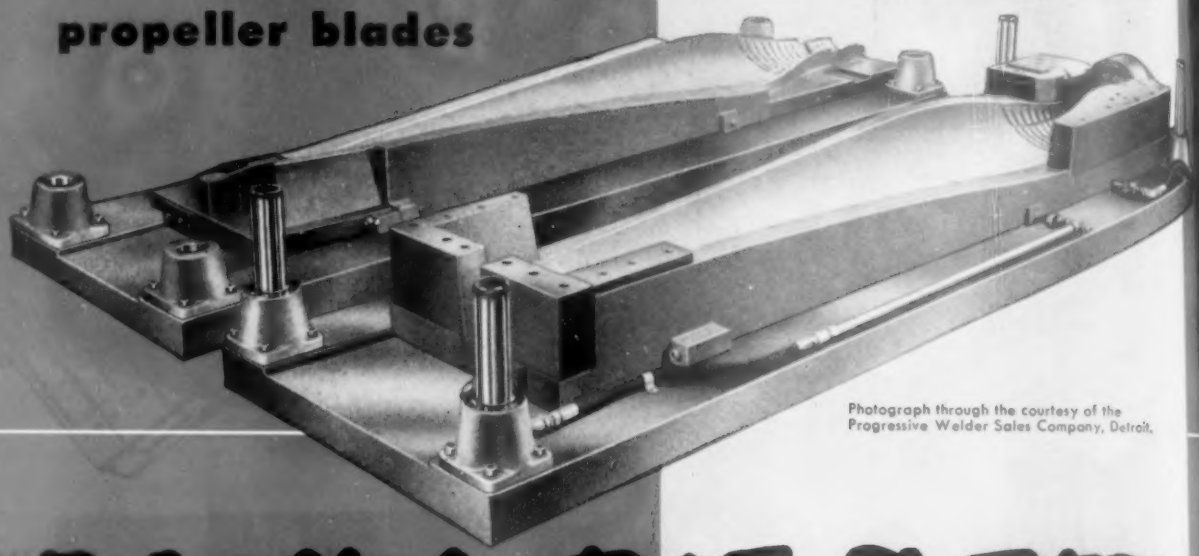
HOT FORMING

aircraft propeller blades

This unique new process takes a previously hot-worked billet and hot forms it into a one-piece hollow steel aircraft propeller. Now, in three steps requiring only a few minutes, a superior propeller is produced that formerly required hours of work.

The development gave rise to the problem of building a special 15 ton die that would provide a quenching action from 1450 degrees in a five minute press cycle.

For a die like this, the diemakers called for...



Photograph through the courtesy of the Progressive Welder Sales Company, Detroit.

DANLY DIE SETS

Reliable Danly precision plus unmatched facilities for the production of standard or special die sets like the one shown here make Danly Die Sets the first choice of diemakers everywhere. A nation-wide system of branch assembly plants* assures prompt, time saving service.

DANLY MACHINE SPECIALTIES, INC.
2100 South Laramie Avenue, Chicago 50, Illinois

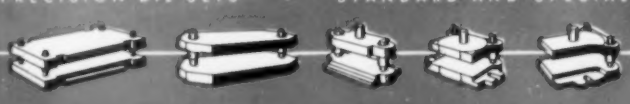
*CALL ON YOUR NEAREST DANLY BRANCH

for fast, local delivery!

*CHICAGO 50, 2100 South Laramie Avenue
*CLEVELAND 14, 1550 East 33rd Street
*DAYTON 7, 3196 Delphos Avenue
*DETROIT 16, 1549 Temple Avenue
*GRAND RAPIDS, 113 Michigan Street N.W.
INDIANAPOLIS 4, 5 West 10th Street
*LONG ISLAND CITY 1, 47-28 37th Street
*LOS ANGELES 54, Ducommun Metals & Supply Co., 4890 South Alameda
MILWAUKEE 2, 111 East Wisconsin Avenue
PHILADELPHIA 44, 18 West Chelten Avenue
*ROCHESTER 4, 16 Commercial St.

*Indicates complete stock

PRECISION DIE SETS • STANDARD AND SPECIAL



DANLY

MORE THAN 25 YEARS OF DEPENDABLE SERVICE TO THE STAMPING INDUSTRY

If broaching isn't the answer, we'll tell you, too.....

The fact that broaching accurately removes metal faster than any other process does not make it a panacea to increase the productivity of ANY operation.

Naturally we want to see broaching used wherever possible. But, today especially, with productivity for defense so vital, we *don't* want to see it used where it shouldn't be used and we *do* want to see it used to its maximum effectiveness.

Colonial's broaching specialists have been through the mill for years on practically every kind of broaching job there is. They know where broaching can and cannot be used effectively. What is more, they know HOW it can be used MOST effectively.

They have learned the hard way that the wrong broach, fixture or machine—even if it costs a few dollars less—is poor economy. It costs more in the long run, cuts productivity.

They want to help you make doubly sure you are right before you release an order for broaching equipment or tooling. They will check your requirements without cost to you.

PIONEERS OF H.S.S. BROACHING

COLONIAL

BROACH CO. DETROIT 13

For Your Tool Room

A wall or bulletin board poster of DO and DON'T items that should help you reduce broach maintenance cost. No charge. Ask for BN-1250.

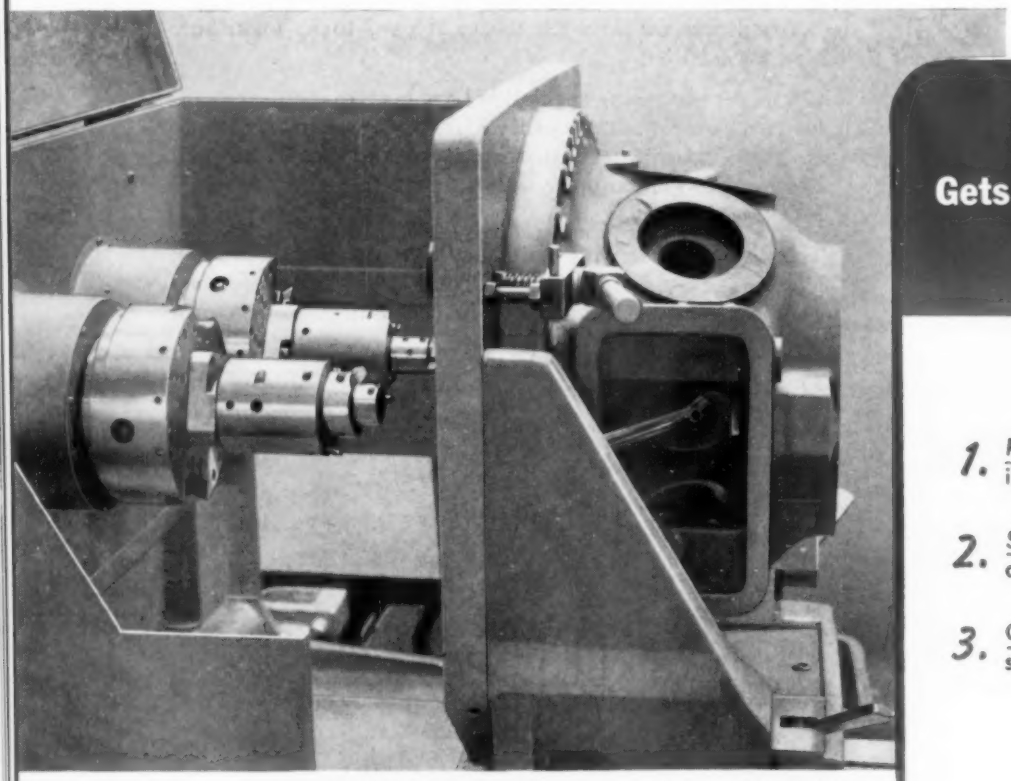
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-23

When the heat's on for civilian or defense production

HEALD PRECISION helps to KEEP 'EM FLYING

In aircraft production, quality and precision take precedence over all other factors. But *speed* can be mighty important, too. Heald machines meet *both* of these requirements — turning out precision finished parts with the highest degree of accuracy, at production rates consistent with customer requirements.

Whether it's a reciprocating or jet type engine— for civilian or military use — Heald can supply the equipment and experience that will smooth the way to faster, easier and better production. Remember — when it comes to precision finishing, it pays to come to Heald.



Heald Model 321 Bore-Matic performs multiple precision borizing operations on magnesium accessory cases for aircraft engines.

New Heald Bore-Matic Gets Aircraft Engine Produ off to a Flying Start

HERE'S WHY

1. *Ready Adaptability* of Heald engi ing to new applications.
2. *Smooth Performance* of basic mac and equipment.
3. *Constant Feed Hydraulics* maintain sistent feed rates throughout longest

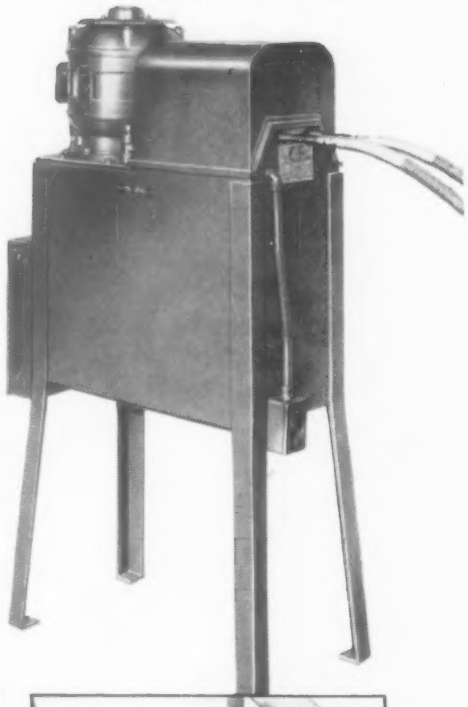
HEALD 125 YEARS

THE HEALD MACHINE COMPANY

WORCESTER 6, MASSACHUSETTS

Branch Offices: Chicago • Cleveland • Dayton • Detroit • Indianapolis • New York

YOU RIVET PUNCH FORM BEND...*Investigate* "HY-POWER" Hydraulics

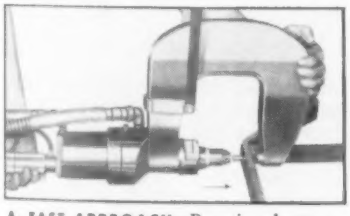


What is "Hy-Power"? The "heart" of the "Hy-Power" hydraulic system is the unique "Hy-Power" Generator—a combination of motor, pump, oil reservoir, control valves and high pressure intensifier assembled as a compact, self-contained unit—an exclusive, highly useful Hannifin development.

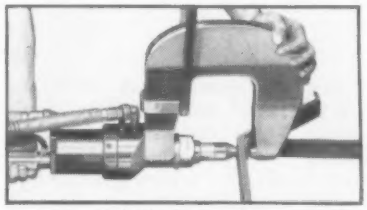
What will it do for you? This "Hy-Power" Generator, operating Hannifin work tools with instantly reversible push-button control, gives you "Hy-Power" Hydraulics; enables you to rivet . . . punch . . . form or bend with forces up to 100 tons (more with multiple cylinders). Everywhere, engineers are turning to this modern hydraulic power source for cost-reducing production.

No doubt *you* can profit through Hannifin's wide experience with "Hy-Power" Hydraulics and practical recommendations for its use in your plant! Hannifin Corporation, 1119 S. Kilbourn Ave., Chicago 24, Ill.

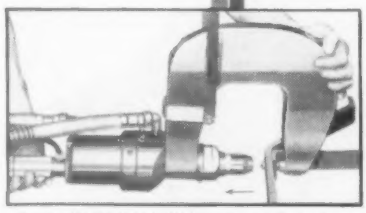
DESIGN ENGINEERS AND TOOLING SPECIALISTS...PUT THIS FINGER-TIP CONTROLLED WORK CYCLE TO WORK FOR YOU!



A. FAST APPROACH—Pressing button (finger-tip control) moves ram up to work at fast speed, using primary hydraulic pressure. *Ram returns instantly to starting position any time button is released.*



B. WORK STROKE—Hydraulic pressure is automatically intensified, and the riveting, punching, forming, bending is completed.



C. AUTOMATIC RETURN—At peak hydraulic pressure (adjustable), the ram reverses automatically; returns to starting position.

do ALL you CAN do...with

HANNIFIN

Air Cylinders • Hydraulic Cylinders • Hydraulic Presses • Pneumatic Presses • "Hy-Power" Units • Air Control Valves

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-25

You Can Select Faster, More Efficient PRODUCTION

from the broader range of Brown & Sharpe Cutters

The closer you match your cutters to each job, the faster, more efficiently they will cut . . . and the less power it will take.

Brown & Sharpe offers a complete range of cutters that permits accurate selection of exactly the right cutter for each cutting job! Styles include every type from plain milling cutters and end mills to metal slitting saws and cutters for special uses. And every cutter is a *quality* product . . . designed and produced to fulfill the enduring accuracy that is built into today's milling machines.

Whenever you order cutters, specify Brown & Sharpe and be sure of getting maximum cutter productivity. Write for complete catalog. Brown & Sharpe Mfg. Co., Providence 1, R. I., U.S.A.

WE URGE BUYING THROUGH THE DISTRIBUTOR

Brown & Sharpe B·S

For those... UNUSUAL TAPPING OPERATIONS

USE S-J SCULLY-JONES

HEAVY DUTY TAP HOLDERS and CLOSE CENTER TAP DRIVERS

EASY TO HOLD AND DRIVE LARGE TAPS

ese rugged, one-piece tap holders are widely used in radial lls, drill presses, turret lathes, horizontal boring mills d similar machines for heavy duty tapping operations.

e thick body wall takes a lot of punishment, yet is t oversize in relation to spindle diameter. Hole and ank are concentric within .002". The hole centers e shank of the tap, and a broached square furnishes positive drive.

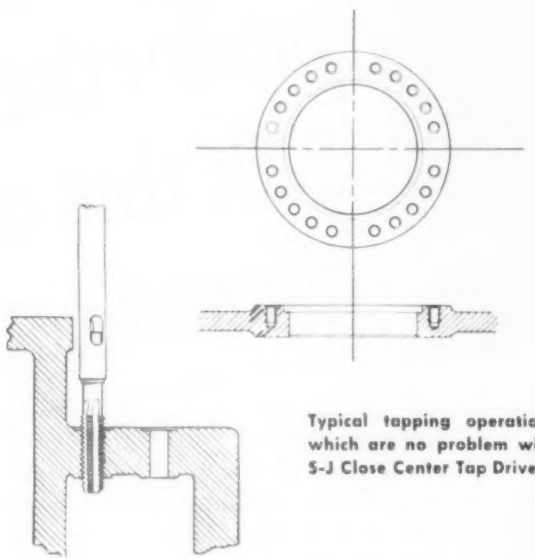
SCULLY-JONES HEAVY DUTY TAP HOLDERS

MAXIMUM CLEARANCE BETWEEN CENTERS

When tapping holes close together or near a shoulder, the S-J Close Center Tap Drivers will do the job. As they are smaller in diameter than machine spindles, they provide maximum clearance between centers.

The hardened, splined section furnishes a positive drive for the square of the tap. Collet action of the split bushing on shank of tap reduces strain, and cuts down tap breakage. As the tap works harder, bushing grips shank tighter. Three series—short, medium and long.

SCULLY-JONES CLOSE CENTER TAP DRIVER



Typical tapping operations which are no problem with S-J Close Center Tap Drivers.

Write for Bulletin No. 4-50
on Scully-Jones Tap Holders and Drivers.
Shows complete range of sizes, specifications and prices.

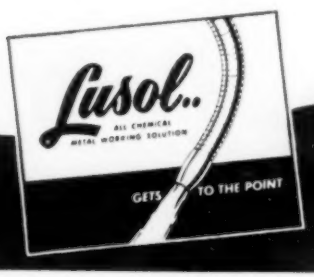
Scully-Jones AND COMPANY

1915 S. ROCKWELL ST., CHICAGO 8, ILLINOIS

YOU GET LOW COST, FAST, ACCURATE PRODUCTION WITH OUR STANDARD AND SPECIAL TOOLS

We want no part of boasting contests-we ask only the chance to show the difference between average and exceptional production possible with this completely different cutting fluid.

Proof: is contained in the 20-page book, "LUSOL—the all-chemical Metalworking Solution". It's free, and so is enough Lusol to compare against any cutting fluid you now use. Simply write: F. E. Anderson Oil Company, 213E, Brownstone Avenue, Portland, Connecticut.



Lusol

ALL-CHEMICAL METALWORKING SOLUTION

GETS TO THE POINT

P. Muir *Editor*
ay Putnam *usiness Manager*

ditorial
T. Kimmel *Associate Editor*
ylander *Western Editor*
. Pratt *T.E. News Editor*
Steiger *Art Editor*
y J. Taylor *Assistant Editor*

dvertising
ce T. Etter *ertising Manager*
G. Cragg *Eastern Manager*
d E. Cleary *Ohio Manager*
F. Girard *Western Manager*
McIntyre *Pacific Coast Representative*
el Jakesy *oduction Manager*
. LaRoue *irculation Manager*

Editorial Committee
F. Sherman, Chair-; Paul F. Rehner, tant Chairman; Joe , Joseph L. Petz, on L. Roessel, D. F. penman, A. M. nit.

Officers
. Demuth *President*
. Bellamy *First Vice-President*
er F. Waindle *cond Vice-President*
. Donovan, Jr. *Third Vice-President*
A. Thomas *Secretary*
C. McMillen *Treasurer*
H. B. Osborn, Jr. *Assistant Secretary-Treasurer*
E. Conrad *Executive Secretary*

Board of Directors
J. Demuth, Chair-; L. B. Bellamy, P. Crosby, T. J. Don-, Jr., V. H. Ericson, W. Ernst, B. J. Haze-kel, A. D. Lewis, J. Schmitt, H. L. ges.

THE TOOL ENGINEER
ublication of The merican Society of Tool Engineers

The Tool Engineer

a Letter from the Editor...

The other day a brochure arrived in the mail from a large, independent research laboratory, which outlined rather interestingly the facilities available to industry and described some of the types of research programs which are currently being conducted.

Toward the end of the brochure were several references to research activities in the field of production or tool engineering, and this started the editor thinking of the amount of research in the field of tool engineering that is being undertaken by industry.

Running down a mental list of recent developments in tooling, machinability, etc., the sponsors in most cases appear to be government agencies, armed forces groups, or manufacturers attempting to better their products or provide more data on their use.

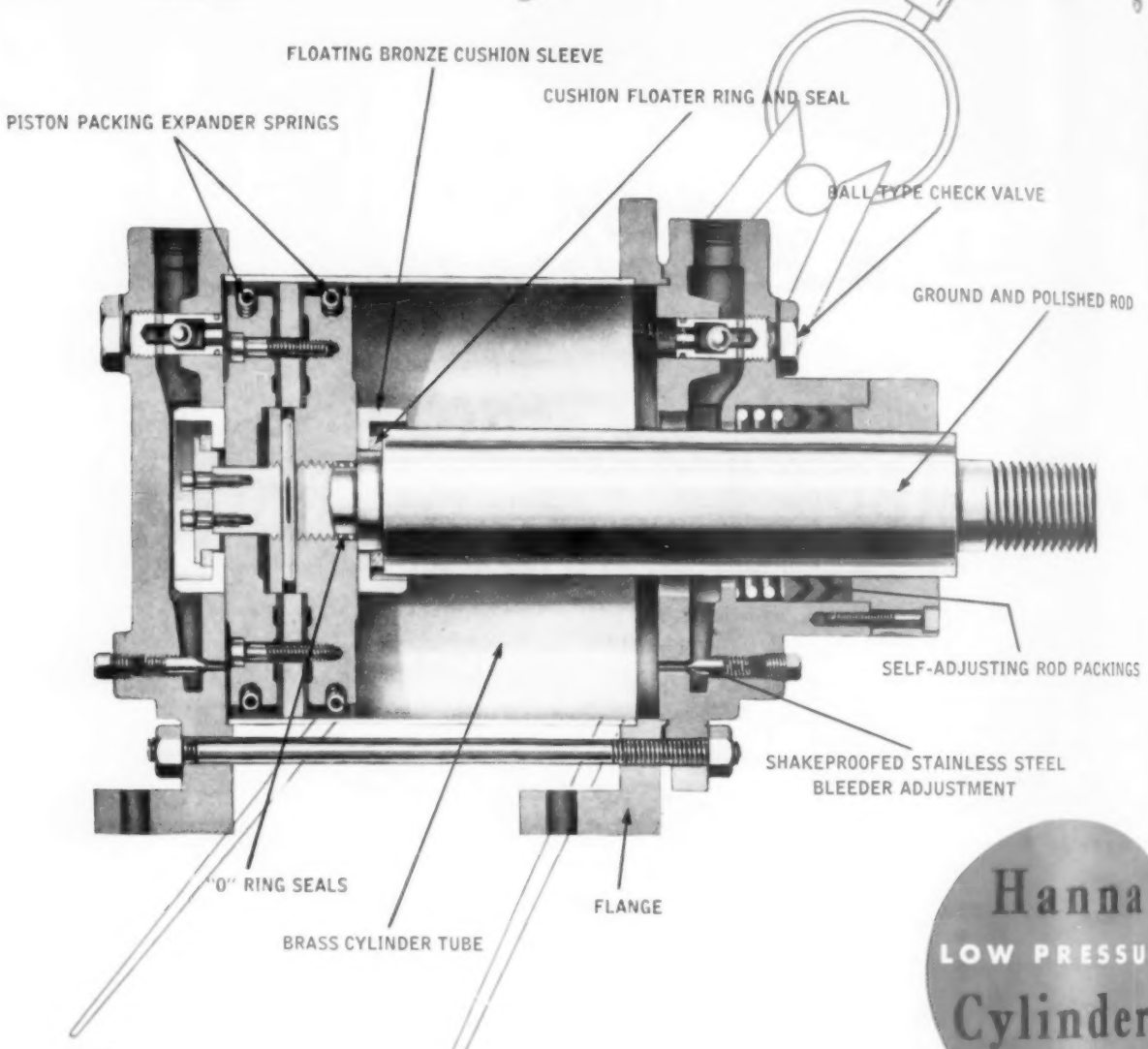
All of these are logical activities for the respective groups, of course, but how many manufacturers producing goods for the consumer systematically undertake investigations of a basic nature on new tooling, new processes or new materials which might save considerable sums in production? Materials, we'll admit, come in for more study than the others mentioned, and many that are not mentioned.

But how many manufacturers put tool engineering research on a relatively long-term investigative basis to explore new fields or new possibilities for their production lines? We mean, by long-term, a project financed over say a three-year period as opposed to an engineer's studying the problem for a month or two to attempt a solution.

I'd appreciate your comments on this; perhaps it might be the basis for a published study on the subject.

Gilbert P. Muir

Are All Air Cylinders ALIKE?



Hanna LOW PRESSURE Cylinders

Not when it comes to cushion sleeves, flange design or the packing of pistons and piston rods. Each of these elements of the Hanna low pressure cylinder provides special benefits for you. Notice the expander springs which insure uniform contact of piston packing with cylinder; the cork floater ring facilitating cushion alignment with head and insuring a seal during cushioning; the spring-backed chevron rod packings, self-adjusting for consistently correct compression; the flange design permitting removal of front head without disturbing mounting. These Hanna-engineered features are refinements resulting from fifty years' experience in design and application of pneumatic and hydraulic equipment. To you they mean increased efficiency—decreased maintenance.

Send for Catalog

For full information on Hanna Low Pressure Cylinders ask for Catalog No. 236

Hanna Engineering Works

HYDRAULIC AND PNEUMATIC EQUIPMENT . . . CYLINDERS . . . VALVES . . . METERS

1768 Elston Avenue, Chicago 22, Illinois

The Tool Engineer

Editorial

A Modern Fable

AT NINE O'CLOCK of a cold morning in December, the officials, directors and stockholders of the X-X Manufacturing Company met to formally close the business, dissolve the X-X Company, and dispose of plant and equipment. The step was a hard one to take, and everyone around the long directors' table seemed to wear a look of incomprehension about the whole proceedings, as if calamity had struck the company overnight without advance warning.

There were losses to the company—some substantial figures in red had been piled up during the several months preceding this meeting—but there would be no great loss in disposing of physical assets, since most of the equipment had long since been depreciated fully, and the buildings would probably bring more than their depreciated book value.

Some 1500 employees would lose their jobs and incomes, though, and in the medium-sized town where the X-X Company was located, this was a serious loss to the community. Some of these people could be absorbed by other companies; others might find some job openings in nearby towns, but unless another manufacturing enterprise were found immediately to take over the X-X Company's plant, many families in this small town would have to move elsewhere to find jobs.

The officers of the X-X Company, distraught over this extreme end result of many months' operation in the red, tried with difficulty to establish some reason for the complete failure of a going manufacturing concern. Engineering was good—they had just provided a product design about six months previously which had great market potential. Sales had been good, particularly with the new product design. Management was experienced in many phases of financial operation.

There is a simple answer to this, of course, and any good engineering counsel could have told them the answer long before that dissolution meeting. Much of that answer lies in the difficulty the X-X Company had in relating a manufacturing cost to an established sales price—established by competitive producers. X-X Company's costs were high—apparently much higher than their competitors'—and an increase in volume just didn't seem to bring about the solution that management confidently predicted that it would.

As a matter of fact, costs went up a bit with increasing production, because it seemed that the tools that production was accustomed to using wouldn't hold up under the higher production rates that were set. Maintenance on machines increased considerably—so much so that one officer of the X-X Company was moved to remark that someday it might be a good idea to buy a new machine. Then, too, with the addition of more new employees the rate of production per worker went down; this was puzzling to a management which reasoned that if the company increased its payroll fifty percent, production should increase proportionately.

This hypothetical instance is not pure fantasy in industry today. Many companies have followed the fate of the X-X Company; many others have for years skimmed just above this level and have been saved only by abnormal business conditions.

The moral, of course, lies in the story—machines so old that their cost of operation is exorbitant; tools inadequate for the job, and used without attempt at re-evaluation; lack of methods study.

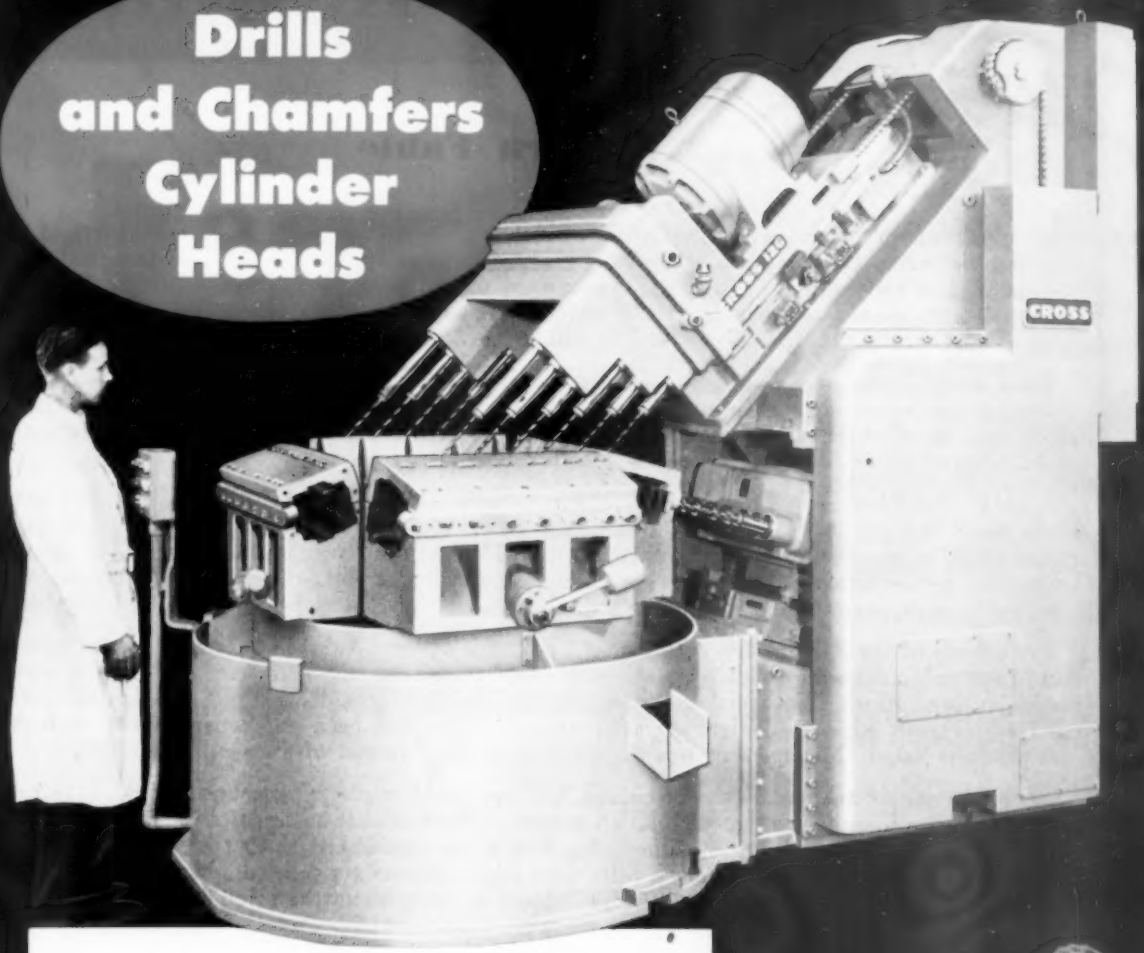
In short, the X-X Company recognized the need for a good product and an efficient sales program, but they overlooked the most important fact of all—that without efficient, low-cost production the salesmen are selling their way to bankruptcy. And unless the principles of tool engineering are applied as an integral part of company policy, that policy must necessarily be as outdated as the machinery scrapped by our hypothetical company.

J. J. Demuth

PRESIDENT
1951-1952

Another Special by Cross

Drills and Chamfers Cylinder Heads



- ★ Drill 12 angular holes and countersink 8 manifold mounting holes in cylinder heads.
- ★ 170 pieces per hour at 100% efficiency.
- ★ Fluid motor, power driven index table.
- ★ Other features—J.I.C. standard construction; stranded wire electrical installation; hardened and ground ways; hydraulic feed.

Established 1898

THE CROSS CO.

DETROIT 7, MICHIGAN

Special MACHINE TOOLS

Ground Surfaces of High Speed Steel Cutting Tools

By Vincent O. Stromberg

TECHNICAL DIRECTOR
REIFF & NESTOR COMPANY

THE MANUFACTURE AND reconditioning of hardened high speed steel tools by grinding is a heat-generating process. The pressure exerted by the grinding wheel against the steel being ground will, by various magnitudes, cause friction which produces heat. The quantity of heat generated and the depth to which it penetrates into the steel to cause injury to the finished surfaces of the tool being ground is an unknown variable.

The intersections of the finished surfaces of the ground tool form the cutting edges. If there is injury on the surfaces due to grinding operations, the cutting edges will also be injured. Excessive heating of the heat-treated high-speed steel tool's surfaces will bring about additional tempering effects to those surfaces. The degree and the depth of softening is a prime factor which influences the length of production time that the cutting edges will stay keen when the tool is cutting. It is, in effect, a major factor of tool life.

The purpose here is not to point out a new problem, but to recognize the fact that softening does occur and to show how to detect it so that the effects can be minimized as far as possible by careful grinding techniques. In a specific instance where tools with a minimized softening condition on the surfaces and resultant edges were used, the production per tool was increased as much as 25 times.

Evidences of softening of the surfaces due to grinding can readily be detected. The degree and depth of the softening can be determined to reasonable degrees of accuracy by means of careful techniques employed in the use of proper superficial hardness testing facilities and metallographical observations of the surface structures.

A typical illustration of the presence of softening in the vicinities of ground surfaces is shown in Fig. 1 which is a micrograph of a tooth of a thread of a tap which has been produced by grinding a thread into a solid hardened high-speed steel tap blank which had no threads on it before thread grinding. The microstructure was brought out by the use of 4 percent Nital Etch of a prepared metallographic specimen. Due to the additional tempering effects produced in grinding, the etched steel is darker in the vicinities of the edges of the tool. To indicate the difference in hardness, there is shown the superficial micro-hardness indentations in the middle area of the tooth where it was not likely to become softened and another which is approximately 0.0004 in. from the edge. The difference in magnitude of

Table 1—Hardness Data for Specimen Shown in Fig. 1

Sample No.	Positions				
	1	2	3	4	5
1	770	1039	1039	807	807
7	770	1098	1098	889	889
10	672	1098	1098	807	593
18	735	1162	1039	770	807
23	672	1039	1039	770	569
50	847	1162	1098	936	847
53	672	1098	1039	889	526
67	1039	1098	1039	735	703

Fig. 1. Micrograph of specimen showing indicative Knoop indentations and the darkened areas where softening exists. (Approx. 250 magnification).

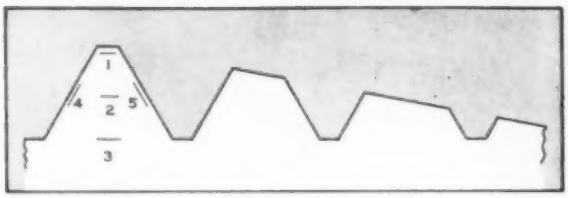


Fig. 2 shows the positions of indentations for surface hardness measurements.

the indentations is a measure of the difference in the hardness.

Hardness determinations were made at positions 1, 2, 3, 4 and 5 as indicated. Positions 1, 4 and 5 were carefully measured at a distance of 0.0003 in. from the edge of the crest and edge at the pitch line, respectively. Readings at positions 2 and 3 are purposely taken in the central areas of the tooth forms where tempering effects due to developed heat in grinding are not likely. Data taken in this manner is shown in Table I. It is evident that the surface areas are softer than the center portions of the tools.

Grindability Unaffected By Heat Treating

From time to time it has been thought that softening effects can be improved by the use of a changed steel analysis or by the application of different heat treating practices to impart to steel used for a tool an enhanced "grindability". Several tools were heat treated in many different ways employing two different types of high speed steels, one being the 18-4-1 type and the other, the M-2 type. Heat treating procedures were employed which involved variation of time and temperature in the high heat and in the tempering. The only requisite to all heat treating procedures was that every tool have a minimum ultimate hardness of Rockwell 64 "C", which was chosen on the assumption that such hardness would be generally accepted as satisfactory for this type of tool. All these tools were ground with one standard set of grinding conditions in order to establish a constant for grinding method.

The results of the investigation of the superficial hardness of these ground tools indicate that softening of the surfaces was present on each and every tool in both cases. There seems to be no apparent relationship between heat treating practice and "grindability" on either type of steel and the degree of softening from the grinding is about the same in both cases of types of steel.

It is important to realize that softening can be present on tools as a result of grinding practices. However, it is equally important to realize the degree and depth of the softening that is present. These two quantities are the contributing influences to the life of the tool when it is in production.

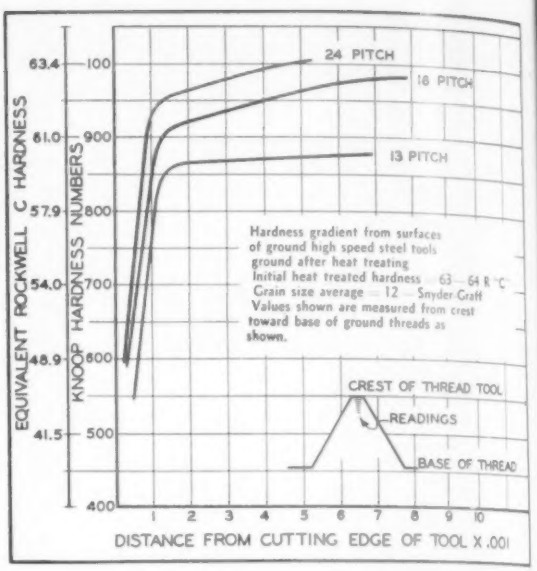


Fig. 3. Typical hardness gradients measured at the crests on three sizes of thread teeth.

With procedures similar to those used in the previous investigations, further experiments were conducted to measure the hardness in minute increments of distances from the edges toward the center of the tools so that a hardness gradient could be established. Comparisons were made on three sizes of thread teeth. Results of these tests are shown in Figs. 3 and 4 where Fig. 3 represents typical gradients at the crests and Fig. 4 represents typical gradients on the flank angles in the vicinity of the pitch line.

It can be seen that the degree of softness is greater on the larger sizes and seems to be less as the threads become smaller. However, it is interesting to observe that the depth of the softening effects is about the same, regardless of the size of thread being ground. The ill effects which cause the softening seem to be confined within the first 0.001 to 0.0015-in. depth from the edges.

The degree of softness developed seems to be somewhat surprising because indications are that the hardness can drop down to the 40-range of the Rockwell "C" scale from an original hardness of 64 R "C". It would indicate that the effective heat developed between wheel and steel must have been quite a bit in excess of 1600 deg F in order for the hardness to drop so much in the very short interval of time that the wheel is in actual contact with the steel. It is obvious that surfaces and edges of ground high speed steel cutting tools which possess such conditions would not have in them the inherent tool life of wear resistance imparted by the original heat treated hardness, regardless of accuracy of design or uniformity of dimensions of the tool.

The problem of making tools with a longer life to yield greater production and more metal remov-

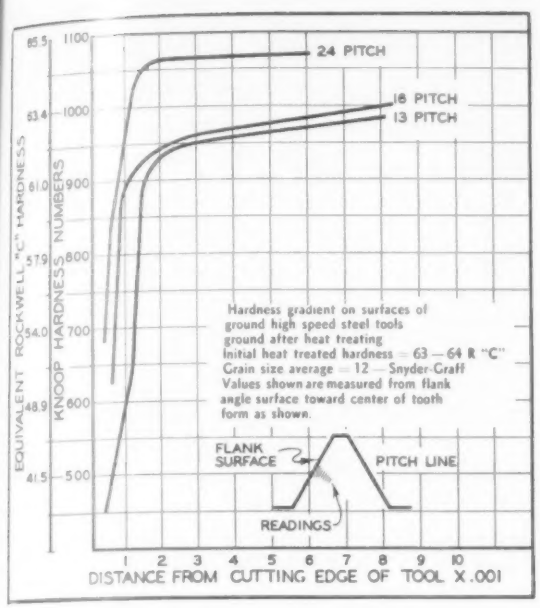

24 PITCH
18 PITCH
13 PITCH
EQUIVALENT ROCKWELL "C" HARDNESS
KNOOP HARDNESS NUMBERS
65.5 1100
63.4 1000
61.0 900
57.9 800
54.0 700
48.9 600
41.5 500
Hardness gradient on surfaces of ground high speed steel tools ground after heat treating
Initial heat treated hardness — 63 — 64 R "C"
Grain size average — 12 — Snyder-Graff
Values shown are measured from flank angle surface toward center of tooth form as shown.
FLANK SURFACE
PITCH LINE
READINGS
1 2 3 4 5 6 7 8 9 10
DISTANCE FROM CUTTING EDGE OF TOOL X.001

Fig. 4 shows the hardness gradients as measured on the flank angles in the vicinity of the pitch line of the three specimens referred to in Fig. 3.

al per dollar of tool investment is one which involves producing tools which possess improved ground surfaces and edges with greater resistance to wear. Results of further experiments are presented to show that these obvious defects can be minimized by proper grinding.

Proper Grinding Increases Tool Life

Omitting details of practices used and techniques derived, it is sufficient to indicate that minimizing softening effects produced tools with a remarkably increased life. In Figs. 5 and 6 are shown micrographs of two tools which were each ground by different grinding techniques. The hardness indentations seen in the photographs indicate that the tool shown in Fig. 5 is softer than that of the second specimen shown in Fig. 6. Both tools were originally heat treated to a hardness of 65 R "C". From the given hardness data, shown in Table II, it can be seen that the tool in Fig. 6 is a decided improvement over the tool in Fig. 5. For comparing Knoop Hardness numbers with the Rockwell "C" scale, it may be noted that 1025 Knoop corresponds to 64 R "C", 950 to 62.2, 900 to 61 and 800 to 58.

Table II—Hardness Data for Specimens Shown in Figs. 5 and 6

Figure	Sample Number				
	1	2	3	4	5
5	507	847	847	936	889
6	889	1039	1039	1939	1039

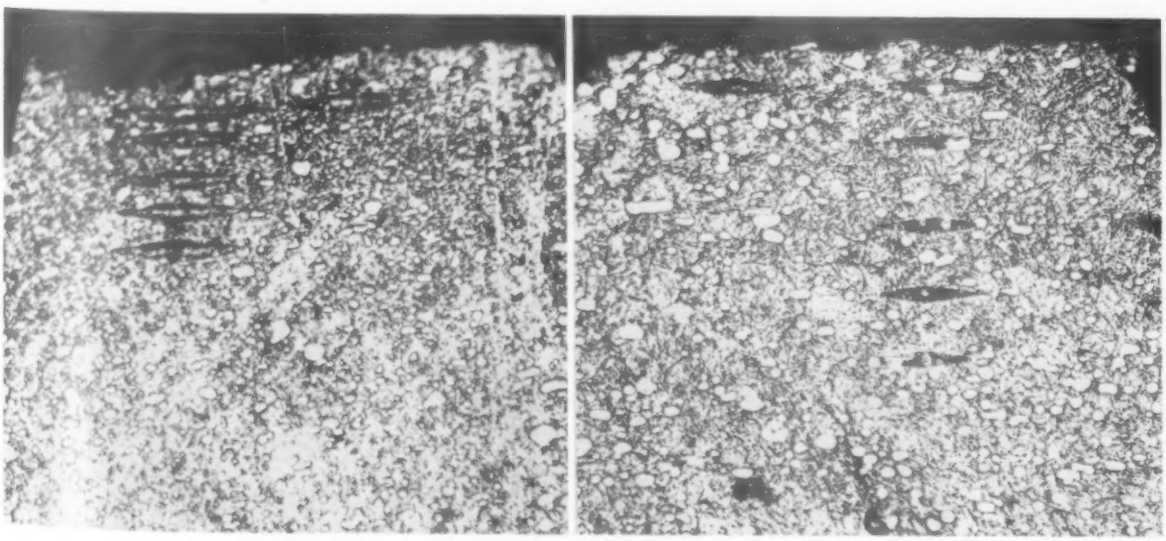
Reading No. 1 is closest to the crest at a distance of 0.0003 in. from the crest edge of the tool. Each successive reading is 0.0005 in. apart.

By the employment of various grinding practices and techniques, each method of application produced, in another group of tests, crests on the threads of taps with resultant hardnesses as follows:

No. 1 Process	988 Knoop or 63 R "C"
No. 2 Process	822 Knoop or 58.6 R "C"
No. 3 Process	935 Knoop or 61.8 R "C"
No. 4 Process	988 Knoop or 63.2 R "C"
No. 5 Process	940 Knoop or 62 R "C"

This data was obtained on the actual crest surfaces of the tool. Results such as these are an improvement over those tools investigated to obtain the data shown in Figs. 3 and 4.

Figs. 5 (left) and 6 (right) are micrographs of two tools ground by different grinding techniques. Note the superior hardness of the tool shown in Fig. 5. Both tools originally were heat treated to a hardness of 65 R "C".



Experimental Measurement of Cutting Forces and Speeds

By J. B. Armitage
VICE PRESIDENT IN CHARGE OF ENGINEERING

AND

A. O. Schmidt
RESEARCH ENGINEER

KEARNEY & TRECKER CORPORATION

PART I

PRESENTED HERE is a summary of power and force measurements in metal cutting experiments conducted and reported within the last fifty years in various countries. Results are presented as much as possible in the same terms and units of measurement. The majority of them are shown here because they can be considered fundamental, correct and important. Some graphs, although they are highly controversial, have been included because they have been, and still are, influencing the thinking of many production men. The diagrams illustrated herein have been collected to present the various findings and theories of many experimenters, not to start a fruitless controversy.

Apparently conflicting statements regarding the relationship of tool forces and power requirements to cutting speed frequently appear in technical journals. Quite often a substantial decrease in power requirement due to high cutting speed, or a particular negative rake angle on carbide tools, has been claimed. However, for practical purposes the tool forces remain constant and are not diminished by higher cutting speeds. There is a linear increase in the power requirement at the cutting tool with an increase in cutting speed.

Frederic Taylor in 1906, summarizing his own data of over twenty-five years of tool testing and those of contemporary experimenters, could not establish a definite influence of cutting speed upon cutting forces. (1)* He states that he found no traceable relationship between the pressure of the chip upon the tool and the cutting speed, although he expected higher tool forces at lower cutting speeds.

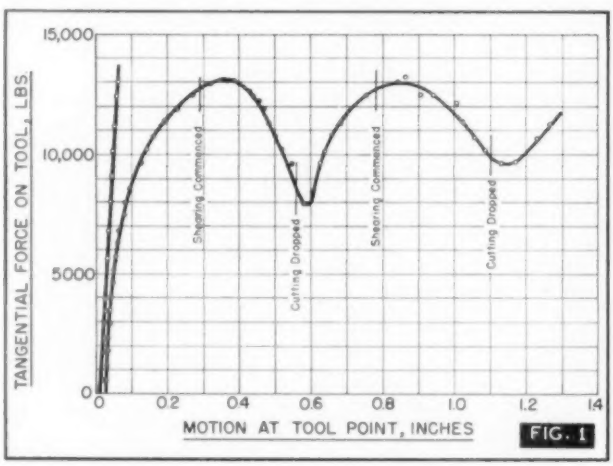
A considerable amount of research in evaluating tool forces has been done and many enlightening and interesting reports have been published through the years.

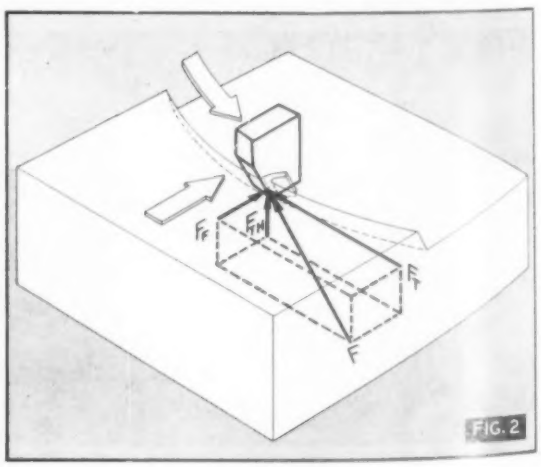
Nicolson and Smith (2) published a report in which they discussed the fluctuations of the cutting force acting on a lathe tool. With a dynamometer they measured the tangential force or pressure upon the tool when turning steel at very low cutting speeds and established a wave-like increase and decrease of the tool force. See Fig. 1.

The power required at the tool is the major

*Numbers in parenthesis refer to bibliography to be included at end of Part II of this article, which will appear in the November issue of *The Tool Engineer*.

Fig. 1. (left). Variations of tangential tool force when turning mild steel at an exceptionally low cutting speed of 0.0033 fpm (1 ft in 5 hrs). Depth of cut, 3/8 in.; feed, 1/4 ipr. Observations were recorded every 0.0625 in. Fig. 2. (right). Schematic diagram of rectangular components of cutting force, F, on a milling cutter tooth were F_T is the tangential component, F_F is the feed component and F_{TH} is the thrust component.





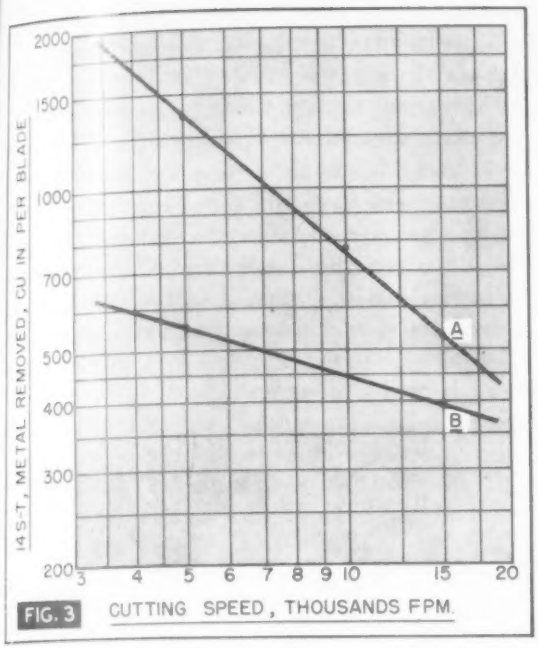


FIG. 3

Fig. 3. Effect of high cutting speed with carbide tools on total amount of metal removed. Depth of cut, 3/16 in., width, 1/4 in. Coolant was soluble oil and water. The milling cutters were run until they showed 0.0035 in. wear on the peripheral clearance face. Cutter *A* had an 11.5-deg axial rake and a 5.5-deg radial rake. Cutter *B* had a 15-deg axial rake and a 15-deg radial rake.

part of the power used by a machine tool. The total tool force is commonly broken down into three rectangular components, of which the tangential component is most important, since it often contributes up to 99 percent of the total power consumed at the tool. This force, F_T, is due mainly to the compression and deformation of the chip. See Fig. 2. If no dynamometer is available, an approximate value of the tangential force, F_T, can be computed from measurements of the net horsepower at the spindle. In this case

$$F_T = \frac{HP \times 33000}{V}$$

where V = cutting speed in feet per minute.

The force, F_F, usually represents the feeding force

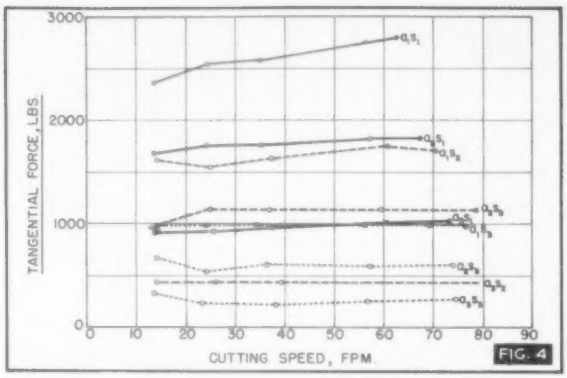


FIG. 4

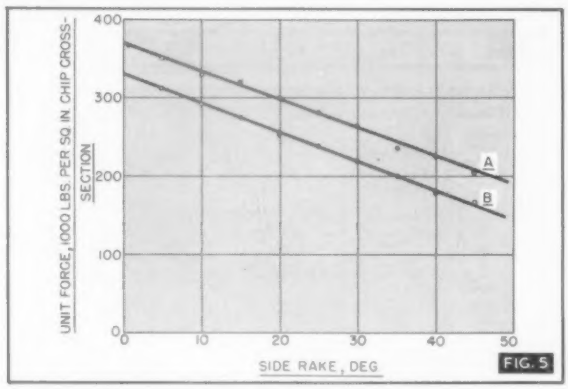


FIG. 5

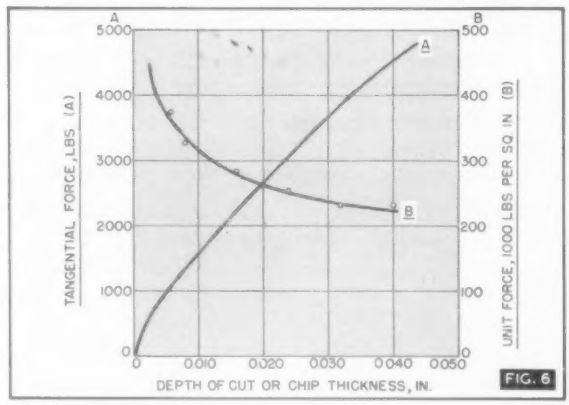


FIG. 6

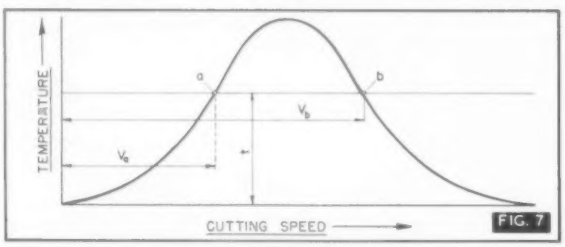


FIG. 7

Fig. 4. Cutting test turning mild steel. Feed: S_1=0.040 in.; S_2=0.020 in.; S_3=0.010 in. Depth of Cut: a_1=0.240 in.; a_2=0.160 in.; a_3=0.080 in. HSS tool with a 16-deg positive true rake angle. Fig. 5. Effect of rake angle upon tool force. Material cut was SAE 3120 with a cutting speed of 20 fpm. (A) Chip thickness was 0.006 in. (B) Chip thickness was 0.012 in. Fig. 6. Effect of chip thickness upon tool force. Tool had a 30-deg positive side rake, the cutting speed was 20 fpm, and the material cut was 1.03 percent carbon steel. Fig. 7. Theoretical diagram about the variations of tool temperature in relation to cutting speed according to Salomon. (*t* is 660 to 750 deg F for tool steel, 1110 deg F for HSS #1020, and 1650 deg F for stellite 1470. Fig. 8. Relationship of tool force and power to cutting speed when milling steel. Depth of cut, 0.120 in.; width, 1.8 in.; feed, 6 ipm; HSS cutter had a 10-deg positive radial rake angle.

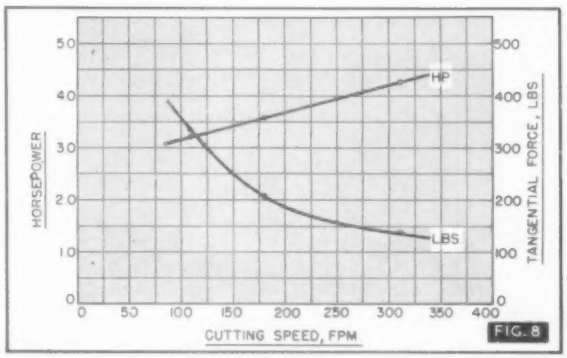


FIG. 8

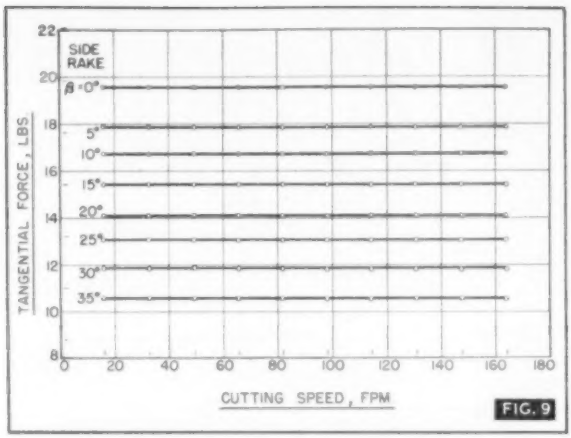


FIG. 9

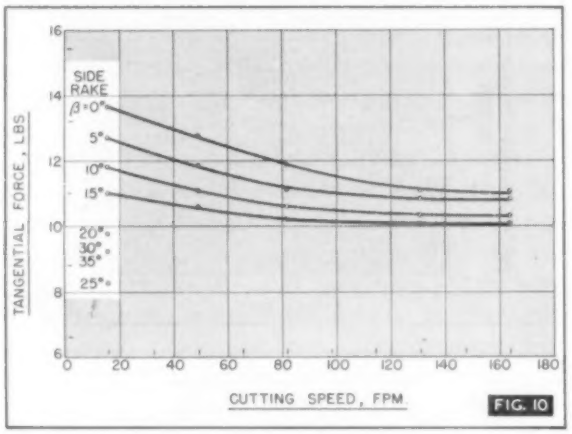


FIG. 10

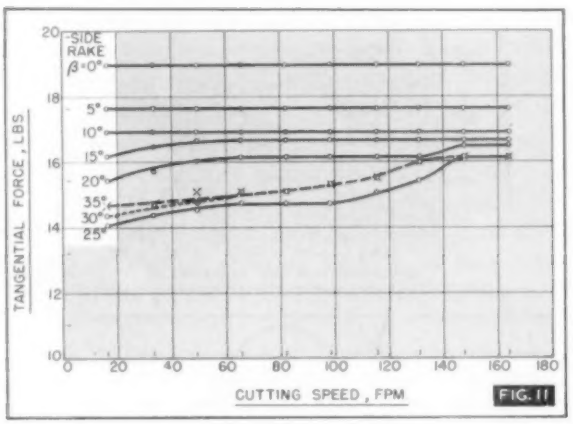


FIG. 11

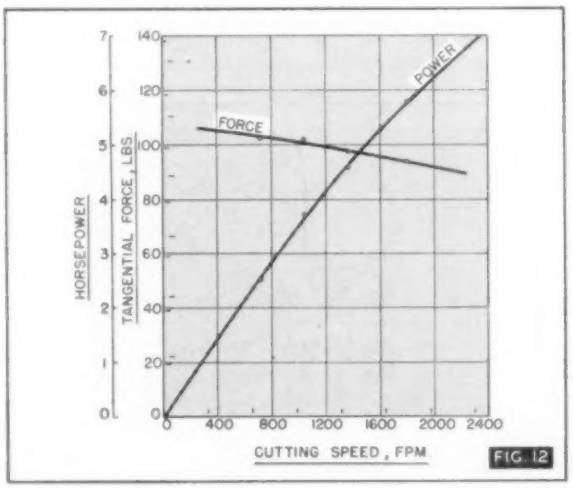


FIG. 12

and can reach high values but requires only a small percentage of the total power. Similar components of the cutting force exist in every machining operation, whether turning, planing or drilling. The orientation of the forces may be different in each case.

Stanton and Hyde (3) found that nickel-chrome steels, when turned, showed minimum tangential forces at a cutting speed of about 20 fpm, and much higher values at cutting speeds of 50 fpm and above. No such great variation was noticed with mild steel.

Speed Increases Wear

Tool wear, besides causing dimensional deviations, will always affect the component cutting forces and will usually increase them. Gechter and Laird (4) investigated the variations in tool forces caused by wear on HSS tools. They used a three-component dynamometer with piezoelectric pressure-measuring elements when turning flanges 2⅜ in. in diameter and $1\frac{11}{32}$ in. long made of various aluminum alloys. Tool wear, although not as pronounced when machining aluminum as when machining steels, will always influence the cutting forces. Rate of wear will generally increase with an increase in cutting speed. Even carbide tools machining aluminum alloys will be thus affected. In Fig. 3 is shown the decrease in the number of cu. in. of 14 ST aluminum alloy milled with carbide tools with increases in the cutting speed from 5,000 to 15,000 fpm. These values were established by Catland at the California Institute of Technology (5) and are based upon measurements of equal amounts of peripheral wear on the cutters. In additional tests in which the net horsepower per cu. in. of metal removed was checked, no changes were observed by Catland when the cutting speed was increased up to 11,000 fpm.

The investigations of Gottwein show that tool forces remain constant while tool temperatures increase with increases in cutting speed and therefore cause more rapid failure of the tool (6). In Fig. 4 are shown tangential tool forces for various cutting speeds and chip cross-sections, each of the latter being held constant while the cutting speed was varied.

When the chip cross-sectional area is increased, the tool forces increase although the force per unit area decreases. These relationships as well as the

Fig. 9. Tangential tool force in relation to cutting speed when turning zinc with various side rake angles. Fig. 10. Tangential tool force in relation to cutting speed when turning cast iron with various side rake angles. Fig. 11. Tangential tool force in relation to cutting speed when turning aluminum with various side rake angles. Fig. 12. Relationship of tool force and cutting speed when turning mild steel.

effect of rake angles on planer tools were determined by Boston (7) and are shown in Figs. 5 and 6.

With the introduction of stellite and carbide materials as cutting tools, practical cutting speeds could be extended much further. This started more speculation regarding the effect of the cutting speed upon tool forces. In 1925, C. Salomon applied for a patent* on a "method" of machining at high cutting speeds. In a diagram such as Fig. 7 it was indicated that tool temperatures reach a maximum at a certain speed and at still higher speeds drop again. In Fig. 7, v_a and v_b are designated by Salomon as critical cutting speeds at which the tool reaches the critical temperature, T, and he recommended that cutting speeds between limits v_a and v_b be avoided. For machining cast iron with HSS tools, v_b was given as 2460 fpm. Although cutting speeds have been extended for all tool materials, a tendency such as indicated by this curve has never been verified on a production set-up, although occasionally experimental verification has been claimed.

A decrease in tangential cutting force when milling steel was reported by Beckh (8) for cutting speeds between 100 and 300 fpm as shown in Fig. 8. This figure also illustrates the higher power requirements due to increased rate of metal removal.

Okochi and Okochi (9) found no difference in tangential tool forces when turning zinc between 15 and 165 fpm, a slight decrease with higher cutting speeds when turning cast iron, and occasionally a slight increase in tangential cutting force when turning aluminum alloys. See Figs. 9, 10 and 11.

In a report on tool temperatures and force measurements, W. Reichel (10), a co-worker of Professor Gottwein, states that tangential tool force is almost independent of cutting speed when turning mild steel up to a cutting speed of 1800 fpm as shown in Fig. 12. This conclusion is based on a large number of thorough tests sponsored by the *Vereins Deutscher Ingenieur* and a research foundation. How various workpiece materials will influ-

*German Patent No. 523,594.

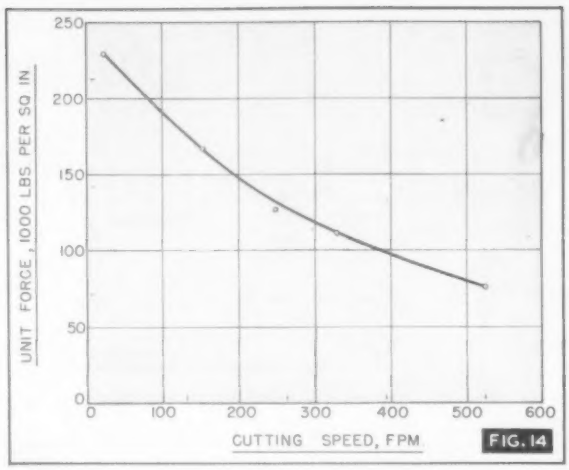


Fig. 14. Effect of cutting speed upon the unit force when turning copper. Side rake, 18 deg; depth of cut, 0.080 in.; feed, 0.008 ipr.

Fig. 13. Tool temperatures when turning wood, aluminum and mild steel. Depth of cut, 0.040 in.; feed, 0.004 ipr.

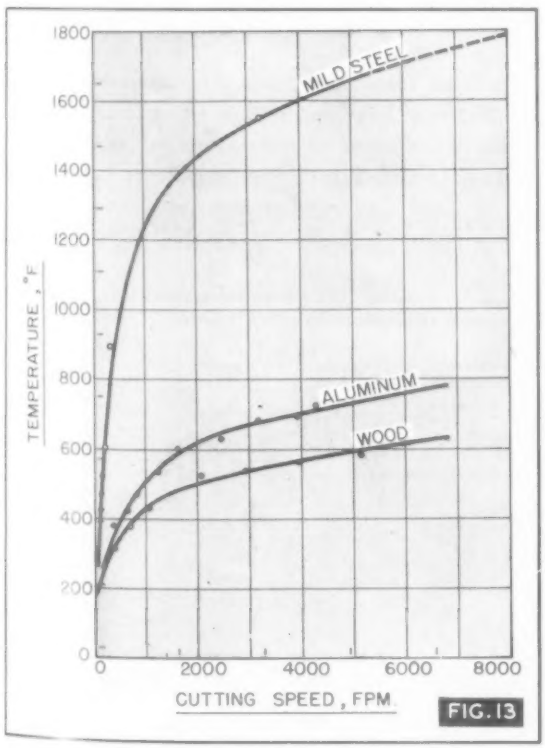
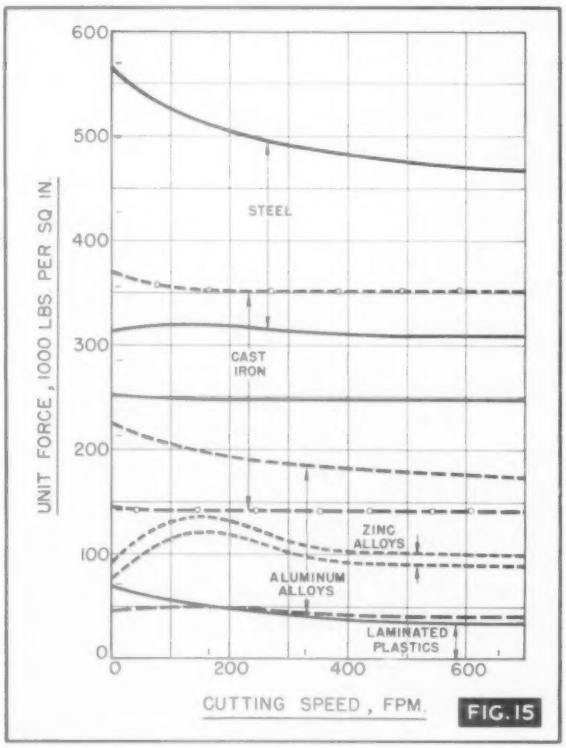
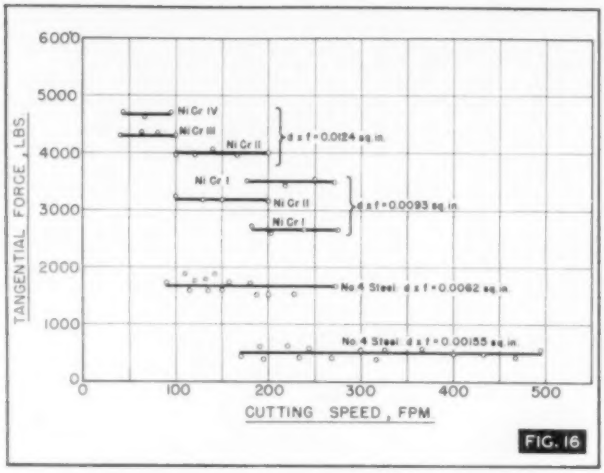


Fig. 15. Unit force related to cutting speed for various materials. Depth of cut, 0.040 in.; feed 0.008 ipr.





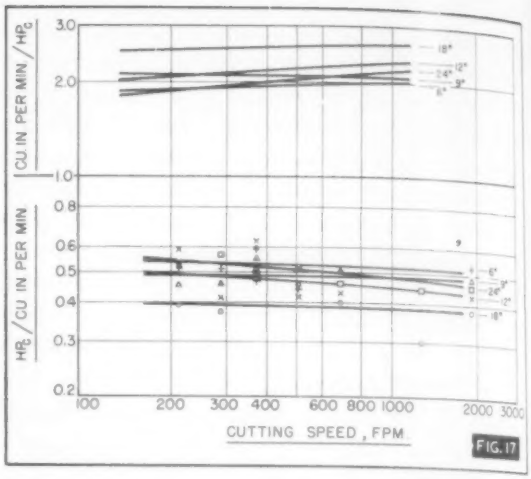


Fig. 16 (left). Tangential cutting force remains practically constant when turning various steels. No. 4 steel has T.S. of 100,000 lb/in.^{2} and 180 to 222 Bhn. Side rake 4 deg, back rake 0 deg, side cutting edge angle 10 deg. Fig. 17 (right). Relation between unit horsepower and cutting speed for face-milling-cutter tooth with a 45-deg peripheral cutting edge angle ground with various relief angles. A 40,000-psi, 190-Bhn "Meehanite" cast iron, having a face width of 4¾ in. was face-milled at a depth of cut of 0.100 in. and a feed of 0.010 in. per tooth with a face mill having a positive 7-deg axial rake and a positive 4-deg radial rake.

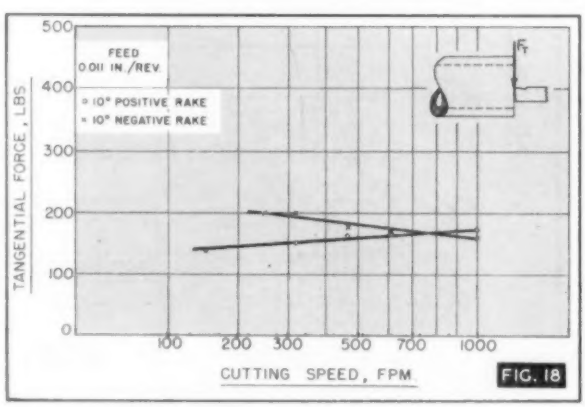
ence the tool temperatures at different cutting speeds is also shown in Fig. 13. The tool temperatures were measured with a tool, having a five-degree rake, made of HSS and carbide, which two dissimilar materials constituted a thermocouple.

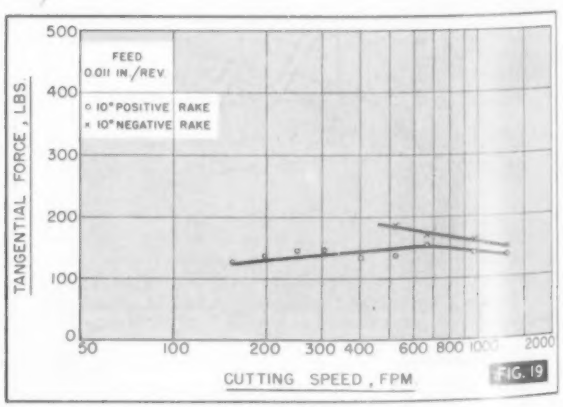
The decrease in specific cutting pressure when turning copper, shown in Fig. 14, is based on values published in *Vereins Deutscher Ingenieur* magazine (11). Unit cutting forces in turning were reported for various workpiece materials by Schallbroch and Hielscher (12). Values in Fig. 15 were determined in investigations of tool temperatures, cutting forces, and speeds at which chromium-plated HSS tools would function properly. It was found that chromium-plated HSS could not be used advantageously when the unit force was higher than about 300,000 lbs/in.^{2}. Chromium-plated HSS tools are therefore recommended mainly for plastics, zinc and light metal alloys, while they are less suitable for cast iron and steel.

No variation of tangential force with cutting speed between 40 and 500 fpm was shown (Fig. 16) by Schlesinger (13) when turning various kinds of steel with HSS, Super HSS, and carbide tools. Boston and Gilbert (14) determined the horsepower when milling cast iron at higher cutting speeds up to 1200 fpm and found that the unit horsepower hardly changed with cutting speed as can be seen in Fig 17, which also means that the cutting forces remained practically constant.

In 1943 a diagram similar to Fig. 18 was published in many technical journals. Tool forces for positive rake angles were shown as increasing, while those for negative rake angles were shown as decreasing with increases in cutting speed. However, it was stated by Hans Ernst (15) in a supplement, "In more recent tests with the machinability dynamometer, it has been possible to extend the upper limit of the range of speeds covered, thus obtaining data of which Fig. 19 is typical. It may be seen from these figures that the force curves do not actually cross at high cutting speeds . . ."

Fig. 18 (left). Curves of tangential cutting force versus cutting speed from data taken in 1942. Fig. 19 (right). Curves of tangential cutting force versus cutting speed from data taken in 1944.





Centrifugal Steel Casting in Permanent Molds

By John Osborn Felt

LEBANON STEEL FOUNDRY

PART 1

WITHIN ONLY THE LAST decade the centrifugal casting process has been perfected to meet the exacting requirements of modern engineering design. This is especially true of the development of ultra-modern techniques for centrifugal steel casting in permanent molds, which opens the door to improved and expanded production possibilities, economical means of manufacturing unusual machine parts, cylindrical shapes, and a variety of applications hitherto over-costly or impractical to produce.

Although pipe tubing and bushing and gear blanks had been centrifugally cast commercially for a number of years in green and dry sand molds, the application of metal molds to centrifugal casting of alloys is comparatively new, and largely an outgrowth of urgent war time requirements.

Demand for circular shapes capable of meeting the aviation industry's needs, subject to X-ray examination and other high standards of acceptance, led to consideration of new methods that would consistently and economically produce circular shapes of higher quality. An outstanding development was a variation of centrifugal casting perfected by Firth-Vickers Stainless Steels, Ltd., Sheffield, England, as a significant corollary to perfection of original jet engine designs.

Success of the early British jet-propelled aircraft power units hinged on the reliability of their circular cast heat-resisting components. As the largest European producer of alloy castings, Firth-Vickers undertook to produce cast rings of heat-resisting materials which would be trustworthy for such critical service. How well they succeeded is now a matter of historical record. The production method, known as the Centri-Die process, made possible the casting of high temperature alloys required in the manufacture of the Rolls-Royce "Nene" and practically all other British turbo-jet engines.

Subsequently, American rights to the process were acquired by Lebanon Steel Foundry, Lebanon, Pennsylvania, for use in production of turbo-jet components for the U. S. aircraft engine program, and the company's high alloy facilities were ex-

Fig. 1. A deep-etched section of a casting with a typical structure.

Tables I, II and III—Physical properties of longitudinal and tangential specimens of centri-die castings, centrifugally cast in permanent molds.

	Longitudinal	Tangential
Tensile Strength psi	101,000	108,000
Yield Strength 0.2 percent offset	83,000	87,500
Elongation in 2 in. percent	23.0	24.5
Reduction of Area percent	63.0	60.5
Izod Impact Ft lb	45—52	—
Charpy Keyhole Impact Ft Lb	25, 26, 26	26, 25, 25
Brinell Hardness	223—228	228—235
Endurance Limit psi	55,000	—

Composition: C—0.10 percent Cr—12.50 percent
Heat Treatment: Normalized and Tempered.

	Longitudinal	Tangential
Tensile Strength psi	79,000	78,000
Yield Strength 0.2 percent offset	40,500	39,500
Elongation in 2 in. percent	47.0	46.0
Brinell Hardness	156	156
Charpy Keyhole Impact	26, 25, 25	25, 24,25

Composition: C—0.07 Cr—19.0 Ni—10.0 Cb—0.90
Heat Treatment: Solution—Air Cooled.

	Longitudinal	Tangential
Tensile Strength psi	76,500	78,000
Yield Strength 0.2 percent offset	40,500	43,500
Elongation in 2 in. percent	60.00	55.5
Brinell Hardness	156	156
Charpy Keyhole Impact	70, 67, 68	66, 63, 65

Composition: C—0.07 Cr—19.0 Ni—9.5 Mo—2.5
Heat Treatment: Solution—Water Quenched.

panded through a $500,000 program designed for specialized centrifugal casting operations.

A variation and perfection of true centrifugal casting, the Centri-Die process utilizes permanent molds instead of the usual refractory molds. In this method, the circular mold or die is rotated about its axis, either horizontal or vertical, while pouring the molten metal and cooling the casting. No center core is used, the centrifugal force causing the liquified metal to assume the shape, as it solidifies, of the mold into which it is poured, cooling from the outer surface toward the center.

From the engineering standpoint, the advantages of such permanent mold centrifugal castings are many as compared with conventional static methods of casting. Briefly, they may be summarized in this way:

1. Higher quality castings with maximum density and physical properties throughout.
2. Readily achieved production of assorted parts and complex structural shapes which cannot be satisfactorily cast by static methods.
3. Centrifugal castings have uniform strength throughout since no flow lines exist in castings.
4. Alloys which are difficult or impossible to forge, due to the extreme heat-resistance and high hardness required, can be centrifugally cast, paving the way to applications otherwise economically unfeasible or impossible.

Physical properties of permanent mold centrifugal castings produced by this method are of a high order since the density and soundness of the product is unusually high. Due to the centrifugal force employed, the molten metal is forced against the walls of the metal mold, bringing to the surface any minor impurities. Solidification takes place in a progressive manner and no centerline shrinkage occurs. Molten metal obviously freezes with a normal dendritic pattern, being finer on the outer surface due to the more rapid rate of chilling.

Some of the coarser dendritic structure is apparent toward the inner surface, as indicated in Fig. 1, which shows a deep-etched section of a casting with a typical structure. It can be seen that solidification is progressive from the periphery inward, and that a complete homogeneity is present.

The centrifugal casting product made in permanent molds is usually rough-machined all over to remove any surface blemishes from the outside diameter and a more appreciable cut is removed from the inside diameter to remove all traces of shrinkage and micro-shrinkage. This assures a product with high internal soundness and physical properties of high and uniform order in any section.

Physical Properties of Test Specimens

Some of the physical properties of a typical Lebanon composition, for instance, 12 percent Cr (AISI Type No. 410), are shown via tests taken on longitudinal and tangential specimens cut out of a casting for test bar tension testing and Izod impact tests. See Table I. Some variation in the properties of tensile strength and yield strength between tangential and longitudinal specimens is to be noted. In each instance, the ductility values are high for the tensile strength and Brinell hardness of the product. The hardness in this instance, over a series of tests, is especially uniform. Impact tests taken from the longitudinal and tangential directions show values with close correlation. The Izod specimens at various locations show values ranging from 45 to 52 ft-lb, which again indicates exceptional impact resistance from high tensile materials. The endurance limit of the centrifugal casting proper for 10,000,000 cycles is 55,000 psi.

Another alloy steel which has gained widespread use in the centrifugally cast heat-resisting field is a Lebanon alloy made of 19 percent Cr and 9 percent Ni containing Cb (Type 347). This is a cast product which similarly shows high physical properties from the casting, with practically the same tensile strength either in longitudinal or tangential directions. See Table II. Charpy keyhole impact specimens show values ranging from 24 to 26 ft-lb, regardless of direction of specimen or the position of the keyhole notch. The Brinell hardness values

Table IV—Heat and Corrosion Resistant Alloys Adaptable for Centrifugal Casting in Permanent Molds

STEEL CASTING SPECIFICATIONS		NOMINAL ANALYSIS					ENGINEERING APPLICATION
Lebanon Designation	Specification	C	Cr	Ni	Mo	Others	
(L) 12	ASTM A-296-46T Grade 10 AMS 5351 AISI 410†	.10	12.50	0.50	....	.....	Heat-treatable
(L) 21	ASTM A-296-46T Grade 5 AMS 5363 AISI 347†	.07	19.50	10.50	....	Cb .80	Weldable grade for high temperature applications
(L) 22	ASTM A-296-46T Grade 1 AISI 304†	.07	19.50	9.0	....	.....	General corrosion resistant alloy
(L) 22XM	ASTM A-296-46T Grade 4 Type 316†	.07	19.50	10.00	2.25	.....	Corrosion resistant and strength at moderately high temperatures
(L) 30	ASTM A-296-48T Grade 7	.15	24.50	13.50	....	.....	Heat resistant alloy
(L) 34		.07	20.50	28.50	....	Cu, Mo, Si	Highly resistant to sulphuric acid
(L) 46	ASTM A-296-46T AMS 5365	.14	24.50	20.50	....	.....	Heat and oxidation resistant
19-9-DL	AMS 5369	.30	19.00	9.00	1.25	Cb, W, Ti	Heat resistant
(L) 130	H.R. Crown Max	.25	23.00	12.50	....	W 3.00	Heat resistant
N-155	AMS 5767†	.15	21.00	20.00	3.00	Co 20.00 W, Cb	Heat resistant
(L) 46	ASTM A296-49T Grade 8	0.20 Max	25.00	20.50	....	.....	Heat resistant

† Lebanon Circle (L) Casting equivalent to wrought steel products.

between the OD and the ID, as well as the heart of the ring, are exceptionally uniform in all instances.

A third alloy steel adapted to exacting centrifugal casting requirements is a Lebanon (Type 316) general corrosion-resitant alloy of the 19-9 series containing molybdenum. Table III shows test results of longitudinal and tangential specimens in tension, which again are of high order; also, Charpy impact keyhole specimens show this grade of material to be uniform in properties throughout.

Still another Lebanon material currently being used for jet engine parts is a mixture of 25 percent Cr and 20 percent Ni which is a corrosion-resistant and high temperature alloy.

These selected types of alloys are now being widely employed for gas turbine applications in which high temperature properties are of utmost importance. A high degree of internal soundness for centrifugal castings of these parts is mandatory, and evidence of test data cited above, together with actual accumulative service records of such parts offers tangible proof of Centri-Die effectiveness in meeting these rigid centrifugal casting demands. The process lends itself to a variety of cylindrical sections which can be made in permanent molds; and the high alloys that can be produced are not by any means limited to the four examples dealt with above in some detail. Centrifugal castings can be furnished to meet the requirements of nationally accepted specifications, together with at least 11 specified heat and corrosion-resistant alloys, and eight carbon and low alloy grades, as listed in Table IV and Table V, respectively, comprising a partial listing of adaptable types and compositions. Other grades, especially those alloys which are difficult to forge, may be produced on special request.

Table V—Carbon and Low Alloys Adaptable for Centrifugal Casting in Permanent Molds

STEEL CASTING SPECIFICATIONS		NOMINAL ANALYSIS					ENGINEERING APPLICATION
Lebanon Designation	Specification	C	Cr	Ni	Mo	Others	
(L) B	NAVY B, 49-S-1 ASTM A-27-48 Grade 65-35 SAE 0030	.25	....	....	....	.....	General structural welding grade
(L) 3*	SAE 4140† NAVY F 49-S-1 ASTM A-148-48 Grade 90-60	.40	1.00	....	.25	.....	High strength low alloy steel
(L) 205A*	SAE 8630†	.30	.60	.60	.20	.....	High strength low alloy structural steel heat-treatable
(L) 205B*	ASTM A-148-48 Grade 105-85	.30	.60	.60	.20	.....	High strength structural alloys
(L) 205C*	ASTM A-148-48 Grade 120-100	.30	.60	.60	.20	.....	Heat-treatable
(L) 205D*	ASTM A-148-48 Grade 150-125	.30	.60	.60	.20	.....	Heat-treatable
(L) 8	ASTM A-217 Grade WC-9	.15	2.40	....	1.00	.....	High temperature alloy to 1050 deg F good creep resistance
(L) 10	ASTM A-157-44 Grade C-5A AMS 5602†	.20	5.50	....	.50	....	High temperature alloy to 1100 deg F

* These alloys are subject to Normalizing, Quenching, and Tempering as required.
† Lebanon Circle (L) Casting equivalent to wrought steel products.

Checking Tapers by the Sine Bar Method

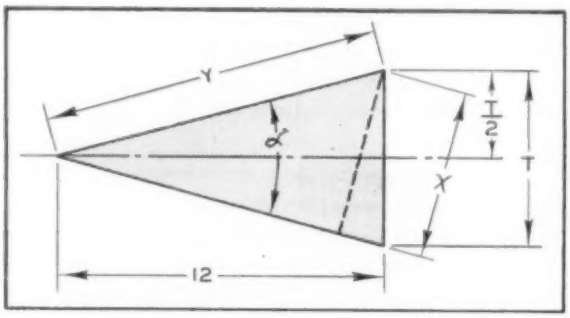
By John W. Lee
R. G. LEE TOOL COMPANY

IN THE MACHINE TOOL FIELD, one of the most common and widely used methods of accurately joining and securely holding two parts together is the taper. Because of the inherent characteristics of a taper, the fit between the male and female parts is of great importance. If there is even the slightest difference in the taper of the two parts, it is obvious that there cannot be a perfect fit.

One of the widely used methods of checking the taper of a male part is to measure the sine of the included angle by the sine bar method. To do this it is necessary to calculate the sine for each and every different taper, and where any indirect method of measuring is used, such as the sine bar method in which the relativity between the given dimension and the direct measurement depends on a mathematical computation, the results cannot be more accurate than the method used in calculating the relativity.

While most toolmakers and inspectors are familiar with the sine bar method of checking tapers, a great many do not use the basic principles of mathematics in calculating the sine of the included angle. A trigonometric solution is possible, but it involves much work and the result is not accurate. The solution presented here entails much less work and the end results are accurate to the last digit.

The final equation, which gives the sine of the included angle in terms of taper per foot, is derived as follows:



$$Y = \sqrt{12^2 + \left(\frac{T}{2}\right)^2} \qquad Y = \sqrt{144 + \frac{T^2}{4}}$$

$$X:T::12:Y$$

$$X = 12\,\frac{T}{Y} = \frac{12T}{\sqrt{144 + \frac{T^2}{4}}}$$

$$\sin \alpha = \frac{\frac{12T}{\sqrt{144 + \frac{T^2}{4}}}}{\sqrt{144 + \frac{T^2}{4}}} = \frac{12T}{144 + \frac{T^2}{4}} = \frac{48T}{576 + T^2}$$

Since this equation is in simple terms of concrete numbers, there is no error introduced by the use of a transcendental function, as would be the case in using a trigonometric solution. A simple analysis of this equation shows its accuracy, and it can be used regardless of the terms in which the taper per foot is expressed.

For example, one series of calculations is all that is necessary to find the five-inch sine bar constant for Jarno tapers which are all alike with a 0.600-inch taper per foot.

Example No. 1—Jarno tapers

$$TPF = 0.6$$

$$\sin \alpha = \frac{48T}{576 + T^2} = \frac{48 \times 0.6}{576 + 0.36} = \frac{28.8}{576.36}$$

$$\sin \alpha = 0.04996876$$

Five-inch Sine bar constant =

$$5 \sin \alpha = 5 \times 0.04996876$$
$$= 0.24984380$$

(Continued on page 52)

Table I—Morse Tapers

Taper number	Taper per inch	Taper per foot	Sine of inc. angle	Sine Bar constant
0	0.052050	0.624600	0.05204946	0.26007
1	0.049882	0.598584	0.04985099	0.24925
2	0.049951	0.599412	0.04991986	0.24960
3	0.050196	0.602352	0.05016440	0.25082
4	0.051938	0.623256	0.05190299	0.25951
5	0.052626	0.631512	0.05258958	0.26295
6	0.052137	0.625644	0.05210159	0.26051
7	0.052000	0.624000	0.05196487	0.25982

Automatic Control of Machine Tools

By J. M. Delfs

MACHINERY DIVISION
GENERAL ELECTRIC COMPANY

In recent years, automatic machine tools have grown rapidly in number, productivity and complexity. In general, these machines represent a higher initial investment than would be required for machines with fewer automatic features. This growth is ample evidence that there are many machining operations on which some increase in initial cost can be justified to obtain automatic operation. Actual operating experience has proved the practicability and economic value of many automatic machines which a few years ago might have been considered a machine designer's nightmare.

The trend toward more automatic operation of machines has a firm foundation on certain facts, both economic and technical. When a new automatic machine is designed or installed, there is usually one of these three goals in sight:

(1) To do a given job at lower cost.
(2) To do a better job at equal cost.
(3) To do a job that cannot be done in any simpler way.

Some of the basic factors which justify increased investment in automatically controlled machines are:

(1) Labor rates are continually increasing.
(2) Production volume is increasing.
(3) Manufactured products are becoming more complex.
(4) Automatic control gives improved quality.
(5) Automatic control of machines gives more effective use of cutting tools.
(6) New machine control systems and techniques have been developed.

(1) Labor Cost and Availability. The higher the value of an hour of human labor, the greater is the investment that can be justified in automatic machinery to eliminate costly time-consuming hand operations.

In an economy of low-priced labor, many modern automatic machines could not be justified. On many jobs it would be cheaper to pay for more hours of direct labor and have lower overhead on machine investment.

During most of the past decade, factories have operated under wartime conditions with manpower a scarce commodity. Productive output had to be greatly increased without a proportionate increase in workers. Automatic machines provided much of the increase in output. Similar conditions of scarce manpower are rapidly returning.

Not only do automatic machines increase the output per worker, but they also make a better job for the machine operator. There is less fatigue and less monotony. The operator is not required to run through the same sequence of operations hour after hour. Although always important, this factor is even more important during a defense emergency when longer working hours are necessary.

(2) Larger Production Volume. Many manufacturers have discovered that production volume has increased sufficiently so that new methods can be justified today which could not have been justified on the lower volume of a few years ago. In the years ahead, an increasing volume of defense production must be supplied while still trying to maintain a high level of production of civilian consumer goods. Larger markets mean larger production volume and larger production volume will justify more automatic machines.

(3) More Complex Products. The products produced today are far more complex than they were ten or twenty years ago.

Compare the 1930 automobile with today's models, complete with high-compression V-8 engine, automatic transmission, automatic engine controls and large expanses of streamlined sheet metal.

The modern jet fighter plane cannot be produced with the same tooling used for its World War II counterpart. The aircraft industry has estimated that today's fighter plane is at least four times as difficult to manufacture as the airplane of World War II.

These more complex products have created ma-

Presented at Annual Meeting, American Society of Tool Engineers, March 15, 1951.

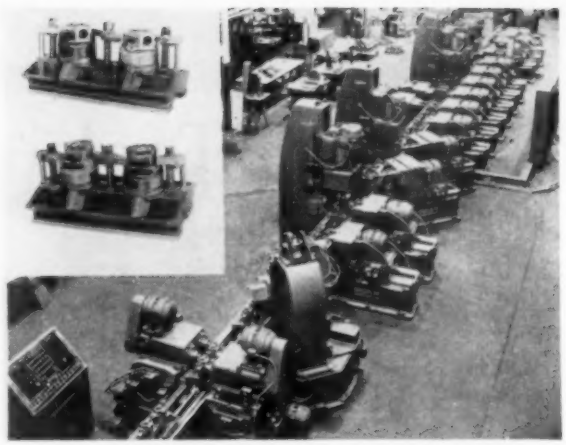


Fig. 1. Typical example of a transfer machine built by Greenlee Bros. performs 152 separate operations on compressor bodies of domestic refrigerator units while the only manual operations required are loading and unloading the castings.

chining problems which did not exist before. In solving these problems, engineers have been forced to develop many new and ingenious automatic machines.

(4) Improved Product Quality. Automatic machines place more emphasis on obtaining consistent product quality through repetitive operation of automatic machines rather than through operator's skill or judgment.

Not only is product quality easier to control with automatic machines, but the quality level can usually be raised.

With automatic machines product quality is designed into the production machine, tools and fixtures rather than trained into the operator.

When an automatic machine is relied upon to consistently give a quality product, the machine cost can often be written off within a short time by reduced scrap loss, less rework, elimination of second operations, fewer rejects, and in some cases, by employing lower-rated labor on the job.

(5) More Effective Use of Cutting Tools. The automatic machine can make more effective use of cutting tools. By working the machine to the limit of capacity of the cutting tool, the output from the machine is increased. With automatic control, the machine operating cycle can be laid out to load the cutting tool to the desired degree, without relying on the operator's judgment to use proper cutting speeds, depth and thickness of chip. Thus, tool life is increased and tool grinding and replacement costs are reduced.

(6) New Control Systems and Techniques. Within recent years, new instruments, control systems and techniques have been developed for controlling work dimensions, measuring and controlling cutter loads, cutting speeds, feed speeds and other operating variables.

The ways in which these automatic machines accomplish the aims of reducing labor cost, improving product quality and increasing output are manifold. The following are only a few typical ways:

(1) Automatic size control, checking and inspection.
(2) Elimination or reduction of manual work handling.
(3) More effective use of cutting tools.
(4) New machine control systems.

Automatic Size Control

Automatic size control attachments on cylindrical grinders are a common example of one way that automatic control contributes to improved product quality.

Elimination or Reduction of Manual Work Handling

On many modern turning and boring operations, with the increased rates of metal removal possible with carbide tooling, machining time has been so greatly reduced that the time now required for actual metal removal is a small part of the overall cycle time. The rest of the cycle is non-productive time spent in getting the work into and out of the machine and transported to the next machine for another operation. If a number of successive machining operations can be performed for each handling cycle, important gains can be made.

In recent years the mass production industries have been giving much attention to this problem. The result has been the accelerated development of transfer machines. Fig. 1 is a typical example. This Greenlee machine was built to machine the compressor bodies of domestic refrigerator units. Many comparable transfer machines can be found in any of the automotive engine plants or domestic appliance plants which have been built or retooled in the last five years. With this machine, the only manual operations required are loading of the rough castings at one end and unloading of the machined parts at the other end. For a single loading and unloading operation on each piece, the machine performs 50 drilling, 12 boring, 16 milling, 38 chamfering and 36 tapping operations. This is to be compared with the number of times the work would have to be handled, the added floor space required, the number of tote boxes needed to hold work in process, and the additional machine operators required, if each of the stations of this machine were an individual drilling and tapping, boring or milling machine.

From an automatic control standpoint, transfer machines of this type are not necessarily complex. The control devices are groups of sequenced relays, cycle timers, counters, limit switches and solenoid-operated valves. The operating cycle of each station

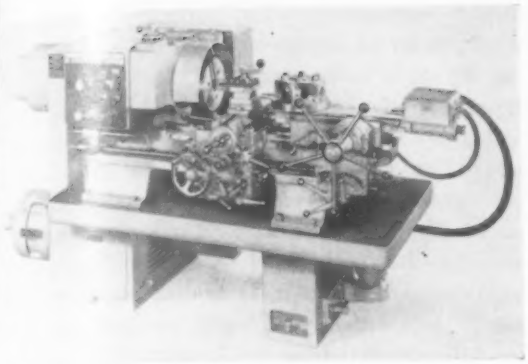


Fig. 2 shows a Warner & Swasey "Electrocycle" turret lathe equipped with automatic control and continuously-adjustable speed control.

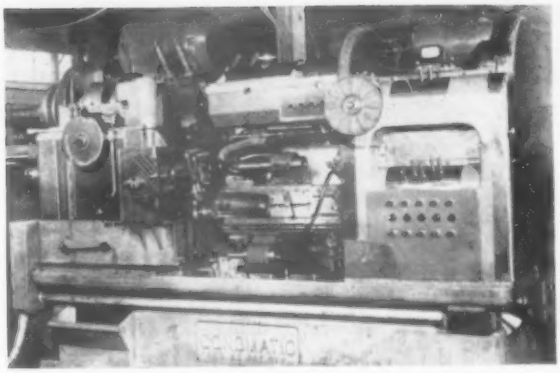


Fig. 3. Five-inch spindle automatic lathe developed by the Cone Automatic Machine Co. which has pre-set feeds rather than pre-set speeds.

can be considered as an individual problem just as though it were a separate machine. Overall operation is then a case of interlocking and proper sequencing of the various stations with each other and with the work transfer mechanism.

In the elimination of manual work handling, it is not necessary in all cases to go to specially designed machines of this type. The Highland Park plant of the Ford Motor Company, producing 100,000 valve guide bushings a day, is an example. These small precision parts require automatic screw machine work, grinding to length, grinding of two outside diameters, and drilling, boring and reaming of the internal bore to tolerances in ten-thousands of an inch. Almost the entire operation is done with conventional machines, including double-disk grinders for grinding to length; roughing, semi-finishing and finishing centerless grinders for outside diameters; washers; automatic screw machines for drilling, reaming and grooving; semi-finish boring machines; finish boring; and reaming machines. Yet, in the overall operation there is a very minimum of manual handling of the work. The individual machines have been equipped and interconnected with hopper feeds, tube feeds, magazine feeds, discharge chutes and belt conveyors, so that work discharged from one machine is automatically transported or conveyed to the loading fixture of the next machine.

Another place where mechanical work handling has grown rapidly is in the press shop. Strip and pinch roll feeds for blanking presses, and the air-operated "iron hand" for unloading of drawing presses are two examples.

One ultra-modern press combines automatic strip feed, automatic transfer of the work through eight die stations, and automatic discharge of the work from the press. This press, of which four are installed at the Hotpoint electric range plant in Chicago, represents far more in the way of automatic control than is evident from first inspection. Feed to the press and transfer of the work through the successive die stations is done entirely by electric motors. The only connection between the main drive of the press and the electric work transfer mechanism is through an electric limit switch, chain-driven from the main crank of the press. Cam-operated contacts on this limit switch control the sequence of operation of the feed and work transfer motors. As the slide rises clear of the work, fast-acting d-c motor-operated, amplidyne-controlled feed drives move in from the sides of the press bed, grip the work, feed each piece accurately into position over the next die station, and then retract clear of the slide as it comes down for the next stroke. The part is blanked from the strip, drawn, trimmed, edges rolled and with each stroke of the press a completed part is discharged.

More Effective Use of Cutting Tools

Tool life, machine productivity, and work finish can be improved by various types of automatic control.

Adjustable Preset Speeds. Adjustable-speed spindle and feed drives are the basis for many of the gains obtained with the newer automatic machines. With automatic control and continuously-adjustable speed ranges, fewer compromises need be accepted on cutting speeds and feeds, so that carbide tooling can be utilized to its fullest extent.

The Warner & Swasey "Electrocycle" turret lathe (Fig. 2) is a good example. This machine is equipped with multispeed motor drive giving four quick-change spindle speeds in each of six ranges, the most desirable range being selected by changeable vee-belt sheaves. Some of the available features are automatic starting of the spindle, automatic spindle speed changes, automatic spindle reversing for the backing-out of solid threading tools, automatic selection of spindle direction for right-hand or left-hand threads, and automatic spindle stop. Of most interest here is the preset speed feature. On the operator's control panel, speed selection dials can be preset so that for each of the six positions

of the turret the spindle will run at that one of the four available quick-change speeds which is best suited for that tool. As the turret indexes, the spindle speed changes automatically to the speed preset for each tool.

A 5-in. single spindle automatic lathe recently developed by Cone Automatic Machine Company has similar features except that on this machine there are preset feed speeds rather than preset spindle speeds. With this machine, shown in Fig. 3 with some of the covers and equipment removed, the operator's panel can be set up to give a different preset feed rate for each of the five end-working slides.

Constant Cutting Speed Control. For some machine operations it may be advantageous to have the machine speed changing continuously throughout a single cut in order to maintain constant surface cutting speed. Consider the case of a lathe on which a facing cut is to be taken on a workpiece of large diameter. As another example consider a boring mill on which turbine wheels are being turned. The cutting tool starts at the outside diameter of the wheel and as it feeds toward the center of the table the tool is cutting on a diameter which is continuously decreasing. If the table runs at constant rpm, the surface cutting speed will continuously decrease. If the cut is started on a 40-in. diameter and continued in to a 10-in. diameter, the cutting speed will change over a 4 to 1 range. However, by using an adjustable-speed drive on the table and coupling the speed control rheostat for the table drive to the head feed lead screw, then as the head feeds in, the table rpm can be made to automatically increase to maintain constant surface feet per minute.

For the example given here, the ratio of maximum to minimum diameters of the cut is 4 to 1. If we compare a constant-speed mill with the mill equipped with constant surface cutting speed control, and assume that on both machines the cut is started on the same diameter with the same cutting speed and feed per revolution, then the machine with automatic control will show approximately a 37 percent reduction in machining time.

Load Regulation. Another example of more effective use of cutting tools by the use of automatic control is on milling machines and grinders where the feed rate of the machine is controlled to maintain constant load on the milling cutter or grinding wheel.

Fig. 4 illustrates a wartime problem in the machining of aircraft engine cylinder head forgings. The cooling fins were to be machined from the solid by a saw-type cutter. From the illustration it is clear that the depth of the cut varies considerably for a single pass around the work. Fig. 5 shows the machine developed for this job. The work is rotated around a horizontal axis by an adjustable-speed electronic motor drive. A separate cam for each cut controls the depth of cut. The cutter is driven at constant speed by an induction motor. By means of a current transformer in the power line to the cutter motor, the load on the cutter motor is measured. This load signal is then fed into the electronic drive which rotates the work, so that as the depth of cut changes and the load on the cutter starts to increase or decrease, the control system automatically changes the feed speed to maintain constant load on the cutter.

Without automatic load control, the feed speed would have to be limited to what the cutter could handle where the depth of cut was greatest, but with load control the feed speed can be increased where the stock is thin, with a resulting decrease in machining time.

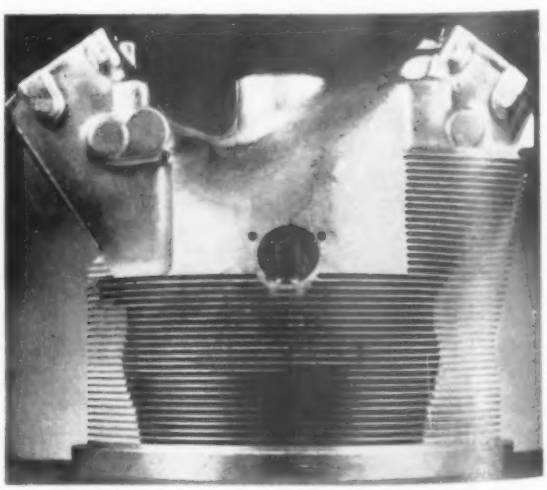
While this principle of cutter load control is illustrated by this special machine, Sundstrand has recently applied the same fundamental principle on some of their more conventional Model 33 Rigidmil machines. In this case, the table feed of the milling machine is powered by an electronic-amplidyne feed drive and the speed of this feed drive can be controlled as a function of milling cutter load.

New Machine Control Systems

Another way in which the utility of machine tools is being increased is by the application of what we can classify under the general title of program control systems.

Under this heading can be classified all machine control systems in which the information that controls the operation of the machine is contained in some form which can be prepared in advance or preserved as a record of that set-up or operation after the job is completed.

Fig. 4. Aircraft engine cylinder head showing cooling fins machined from the solid forging.



Tracer Controls. The most common types of equipment under this heading are the various forms of tracer control. On tracer-controlled machines a wood, plaster or metal template determines the shape to which the work is to be machined. A rough check indicates at least 18 machine tool manufacturers who offer some form of tracer control as a regular or optional feature on their machines. Tracer control has been commonly used for many years for the milling of irregular shaped objects such as molding or drawing dies. Tracer control is the only reasonable solution to this problem, especially on large dies such as those used for automotive sheet metal work.

The most significant growth in the use of tracer control has been for medium lot production on many types of turning, boring and milling machines. Lathe work illustrates fairly simply the field of application of tracer-controlled machines for medium-lot production.

At one extreme, if large-volume production is required it would be better to tool up an automatic production lathe with multiple tools. Machining time would be reduced by the faster metal removal obtained with multiple tools. At the other extreme, if only one or two parts are required and no sample part or template is available, an operator could turn out the part on an engine lathe working from a blueprint in less time than would be required to make a good template. Between these two extremes the tracer-controlled machine is a solution for medium-lot production, especially if the production lots repeat at intervals so that it is worth while to store a template or sample part for future use.

Photoelectric Line Follower. When a large number of irregular profiles are to be cut, the problem of making a single three-dimensional model or individual sheet metal templates can be very costly and time-consuming. With the machine shown in Fig. 6, the operation of a milling machine is controlled photoelectrically from a line drawing.

This particular set-up includes two machines, a scanning machine and a milling machine. The profile to be machined is either drawn by hand or produced photographically as a black line on white background. This line drawing is then placed in the scanning machine where a photoelectric scanning head follows automatically and continuously along the line to be machined. Signals transmitted electrically from the scanning machine to the milling machine operate the feed motors on the table of the milling machine to machine the work to the profile shown on the drawing. With this arrangement, the drawings are made five times as large as the work so that errors in drawing the line are reduced by a 5-to-1 ratio at the work. If the size ratio between the drawing and the work were always one-to-one, the two machines could be combined.

Cost savings produced by this machine compared to former hand work methods have been so great that the original investment in the machine has been paid back within a short period of operation. In addition to cost savings, jobs which formerly required weeks are now completed in a few hours.

Magnetic Recorder Control. Another system of automatic machine control which has recently been developed and demonstrated provides control of a machine tool from a magnetic tape recorder. Fig. 7 illustrates in schematic form the system involved. To make the recording the machine is run through the sequence of operations required to machine a part. During this operation the recorder makes a continuous record of all movements of the machine feed drives. Once the recording has been completed, the machine will repeat the same motions and same cycle of operations merely by playing back the recording. The recording can be replayed to make as many parts as desired or stored for future use if additional parts are required at a later date. A completely

Fig. 5. Saw-type cutter with automatic load control which was developed to machine the cooling fins as shown in Fig. 4.

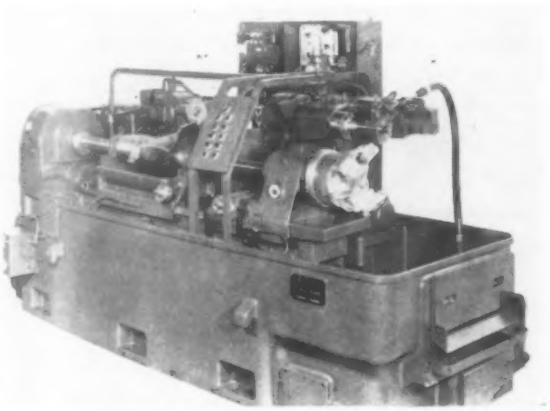
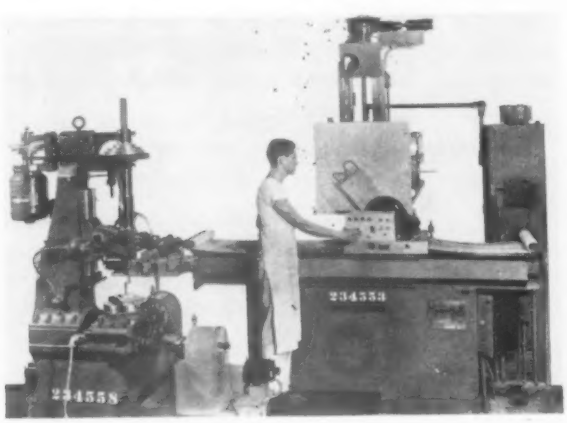


Fig. 6. A milling machine equipped with a scanning device which controls the milling operation photo-electrically from a line drawing.



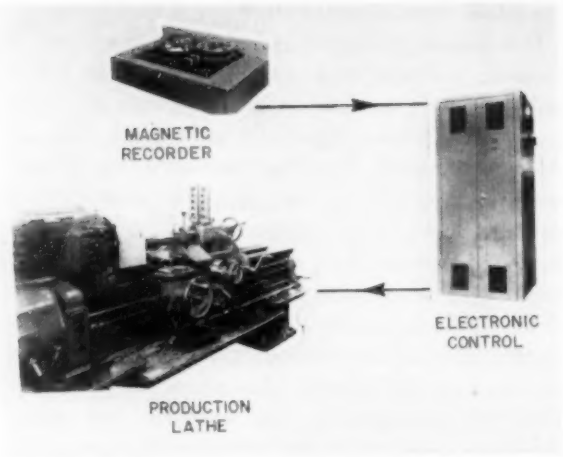


Fig. 7. A schematic diagram of the set-up for controlling a machining operation by means of a magnetic recording.

automatic cycle can be laid out so that after completion of the machining, the machine feeds will return to their starting position, the machine will stop, and the recorder will reverse and rewind to the starting position, ready for the next cycle.

The feed motors are continuously controlled so that the machine can turn tapers and generate radii and irregular shapes. The machine can be arranged to take a succession of roughing and finish cuts, change spindle speed as desired, operate any electrically operated fixtures such as coolant pumps or valves, air or hydraulically-operated chucks or clamps, loading and ejecting fixtures, etc.

These examples are only a few which are representative of some of the jobs which can be done with automatic control systems on machines.

Operating Problems

While the operating advantages of automatically controlled machines have been recognized, there have arisen some problems associated with the introduction of these machines into the shop. There have, of course, been labor problems which in many cases have made it difficult to actually obtain the increased output of which the new machines are capable. However, of more direct interest here are the problems which relate to the design of the machines.

Maintenance. On many automatic machines the operator's job has been simplified to the extent that his only function is to load and unload the work and in some cases even that is done for him, so that his only job is to oversee a group of machines. On the other hand, the hydraulic and electric control systems on the machines have become more complex so that the maintenance man's job has become more difficult.

The JIC Standards for electric and hydraulic equipment on machine tools were in a large part prompted by a demand on the part of the automotive industry for machine tools that are easier to service. In machine design there is greatly increased emphasis on making the electric and hydraulic equipment more reliable and easier to service when required. With more automatic machines there has been something of a shift in responsibility for getting out production and maintaining quality from skilled machinists to skilled set-up and maintenance men. To cite the extremes, years ago maintenance meant a few drops of oil in the right place at somewhat irregular intervals. Today, although the new machines are more reliable and more productive, a higher grade of maintenance help is required. Few large metal-working or fabricating plants can afford to be without the services of at least one or more maintenance men capable of servicing relatively complex electronic and hydraulic equipment.

Flexibility. One of the penalties often associated with the automatic machine is lack of flexibility. The standard automatic screw machine, the automatic lathe and many others are very flexible machines capable of producing a wide variety of work. However, in the mass production industries many of the machines are highly special automatic machines designed to produce only one part or in many cases to perform only one or more operations on a single part. Machines of this type must show cost savings sufficient to pay for the machine over the very few years that a particular model or product design will be in production. Thus, while the engine lathe or the general-purpose milling machine in the tool room or development shop will have a useful life of many years, the highly specialized automatic machine may become obsolete as soon as the design of the manufactured product is changed. Wherever possible the single-purpose automatic machine must be designed so that by changing tooling and fixtures the machine will still be usable when product design changes are made.

ERRATUM

In the article, "Production Drilling and Trepanning of Deep Holes," published in the September issue of *The Tool Engineer*, drawings which appeared on page 34 carried incorrect captions.

Fig. 7, at top of page 34, shows the details of the arrangement for modern trepanning. Fig. 8, which appeared at the bottom of the same page, illustrates a boring tool.

State Takes Over Steel

By Harold Hutchinson

INDUSTRIAL CORRESPONDENT
LONDON DAILY MIRROR

ALMOST THE ENTIRE BRITISH iron and steel industry was nationalized on February 15, thus completing the policy of placing the basic industries and services of the nation under State control.

An essential difference between the nationalization of steel and that of other industries is that care has been taken to preserve the idividual iron and steel companies, whose names and products are world-famous, while giving overall national ownership and control. The individual companies continue working with the same managements and technicians, competing with each other, and maintaining their selling organizations at home and abroad.

Relations between workers and management in the steel industry have always been close and friendly and the general atmosphere has been one of cooperation for mutual benefit. These relationships, built up over generations, remain untouched by nationalization since the companies retain their identities, their managements, and their characteristics.

Eighty of the steel companies in Britain, with more than 100 subsidiaries, are included in the new organization. Companies not in the scheme include those making steel for a specialized purpose (for automobiles, for example) and those whose production is less than 20,000 tons a year. The fundamental change is that on February 15, the State Iron and Steel Corporation of Britain became the sole shareholder in the 80 companies. Steel bonds, fixed on the basis of security prices during a certain period of either 1945 or 1948, whichever is the more favorable, were issued in compensation to the present shareholders.

Similar to a Holding Company

The Corporation has emphasized its intention to leave the affairs of the companies largely in the hands of their own managements. It sees itself acting like a holding company in ordinary commercial practice. Existing Boards of Directors remain responsible for the efficient conduct of their companies within the general policy laid down by the Corporation. Each company will continue to issue separate annual reports. But the Corporation will also have power, if it wishes to exercise it, in the election of directors and the appointment of senior executives. The Corporation will issue one annual report covering the working of all the nationalized companies.

There was an interim period of three months during which the new Corporation and the existing iron and steel organizations, particularly the British Iron and Steel Federation, which was the main organization of the privately owned steel industry, were to determine the degree of their co-operation and the merging of their functions.

The Corporation consists of a Chairman and six other members, but four more may be appointed, and the Corporation hopes that these will come from within the steel industry. There has been a marked reluctance by many leading figures in the steel industry to accept membership of the Corporation.

The industry has opposed nationalization, though it has not objected to—and has indeed participated in—a large measure of overall State direction since 1940. The Conservative Party, led by Mr. Churchill, has announced that if it is returned to power at the next election, it will de-nationalize the industry.

The steel industrialists have thus been faced with a dilemma. A political party pledged to nationalize their industry has twice been elected by the people as the Government of the country, and a nationalization act has passed through Parliament. It is law. The industry accepts that, as it must. But it does not conceal the fact that it does not like it, and since there is a possibility of a change, many of the leaders of the industry are keeping themselves as detached as they can from the actual conduct of the new Corporation.

Reason for Nationalization

The question whether such a vigorous industry as steel should be nationalized was fought out on broad issues. The key position of the industry provided a principal reason for nationalization. Was it possible to leave this basic industry in private ownership when the economy of Britain and so many other vital industries depend on steel?

There were two other issues stemming from this. In the past 20 years the industry has organized

itself closely in the Iron & Steel Federation. Rightly or wrongly, many people considered that if it was inevitable that the industry should grow to resemble a trust, then it had better be a national trust. There was also the question of development. Is it possible for a privately-owned industry, which is responsible to its shareholders, to carry out major financial undertakings in periods of slump? Nationally, it was argued, the best time to modernize, re-equip and re-build steel capacity is when the demand for steel is low, since there is then ample available labor, and the capital cost is likely to be low. The argument is that this is socially valuable, since it provides employment and helps to prime the economic pump, and economically sensible, since the process is cheaper. Furthermore, it was argued that the planning and capital expenditure necessary to provide the expansion of capacity in times of slump could only be done on a national basis.

The steel industry agreed that it was desirable to work out prospective needs, allocate capital expenditure and so on, and do it on an industrywide basis. In fact the industry has played the major part in the Iron & Steel Board which was created some years ago to co-ordinate the postwar expansion of United Kingdom steel capacity.

Steel production in the first half of 1951 is running at an annual rate about 300,000 tons below 1950. This is the result of a sharp fall in imports of iron ore and German scrap. German scrap available to the British industry this year will be not more than 600,000 tons, compared with two million tons in 1950.

During the second half of last year the industry's stocks were run down. The industry does not own its ships, and the sudden increase in demand for shipping to carry a million tons of coal across the Atlantic, grain to India, and supplies to Korea, made it impossible to charter enough ships at the right time. It was a matter then of drawing on stocks or reducing output. Rightly or wrongly it was decided to draw on stocks. Before steel came under national control it was well known that production in 1951 would be less than in 1950 and that the upward trend of production would be put into reverse for one year at least.

British steel exports will be cut correspondingly, and supplies to the home market will be maintained at about the 1950 level, though the allocation of the steel will be different to meet the needs of rearmament.

Prices will certainly rise this year but this is the inevitable result of rises in the costs of raw materials, freight, and the higher wages which are the general consequences of the rising cost of living. British steel is very cheap and prices will remain relatively low even if the anticipated increases are substantial.

By 1952 the country's pig iron capacity is due to go up by a million tons, and this is the key to Britain's expectation of higher steel production in 1952. The signs are that shipping is going to be available, and the United States is placing eight Liberty ships at Britain's disposal to bring ore to British ports from the Mediterranean, where they will discharge American coal. This, and a new national campaign to collect all available scrap, will carry Britain through 1951. Thereafter Britain will get a million tons a year of Newfoundland ore, and this, coupled with increased pig iron supplies, leads to the expectation of rising production again within twelve months.

Checking Tapers by the Sine Bar Method

(Continued from page 36)

The American Standard Steep Machine tapers are also all alike with a 3½-inch taper per foot. To find the five-inch sine bar constant:

Example No. 2—American Standard Steep Machine tapers. TPF = 3½ in.

$$\sin \alpha = \frac{48T}{576 + T^2} = \frac{48 \times 3.5}{576 + 3.5^2} = \frac{168}{588.25}$$

$$\sin \alpha = 0.28559286$$

Five-inch sine bar constant =

$$5 \sin \alpha = 0.28559286 \times 5$$
$$= 1.4279643$$

Table I, for all Morse tapers shown in the ASTE *Tool Engineers Handbook*, shows the taper number, taper per inch, taper per foot, the sine of the included angle and the constant for the five-inch sine bar. Table II shows the same values for all Brown & Sharpe tapers as shown in the same publication.

Table II—Brown & Sharpe Tapers

Taper number	Taper per inch	Taper per foot	Sine of inc. angle	Sine bar constant
1	0.0418333	0.50200	0.0418152	0.209072
2	0.0418333	0.50200	0.0418152	0.209072
3	0.0418333	0.50200	0.0418152	0.209072
4	0.0418666	0.50240	0.0418483	0.209241
5	0.0418000	0.50160	0.0417817	0.208908
6	0.0419408	0.50329	0.0419223	0.209611
7	0.0417891	0.50147	0.0417882	0.208941
8	0.0417500	0.50100	0.0417318	0.208659
9	0.0417375	0.50085	0.0417193	0.208596
10	0.0430100	0.51612	0.0429901	0.214950
11	0.0417500	0.50100	0.0417318	0.208659
12	0.0416441	0.49973	0.0416261	0.208130
13	0.0416841	0.50021	0.0416660	0.208330
14	0.0416666	0.50000	0.0416486	0.208242
15	0.0416666	0.50000	0.0416486	0.208243
16	0.0416666	0.50000	0.0416486	0.208243
17	0.0416666	0.50000	0.0416486	0.208243
18	0.0416666	0.50000	0.0416486	0.208243

High-Production Abrasive Belt Grinding

By W. A. Papworth

STAFF ENGINEER

PORTER-CABLE MACHINE COMPANY

ABRASIVE BELT GRINDING or finishing is a much more recent manufacturing method than turning, milling, or grinding with solid wheels, and, therefore, its applications are less well known. They may be separated into two fields:

(1) **The mechanical grinding fields.** Here, the job is to grind a flat, square, parallel or round surface, or to grind to some specified dimension.

(2) **The finishing field.** Here, the prime goal is surface finish, smoothness and appearance, with little or no emphasis on mechanical characteristics.

Belt grinders are essentially low-cost equipment; they are less complicated, and require less man-hours and material to produce than most machine tools. Jigs and fixtures are generally simpler and cheaper, and require less set-up time. For tool-room use a belt grinder with feed table can be a time saver. Steel fixture components are quickly sawed off 0.030 to 0.040 in. long and squared to length. Chamfering, bevelling, generating radii and removal of welds can be accomplished rapidly and easily.

Equipment and Methods

For flat grinding a platen is used behind the belt to provide a flat grinding surface. A belt 8-in. wide, travelling at 5000 fpm, with #80 grit abrasive, theoretically flows 38,000,000 grits per minute past the grinding point.

The high production rate in platen grinding comes mainly from grinding all over the workpiece at once, from the fact that work holding does not need to be as secure as for other types of machining, and also from reduced loading and unloading time. It is most efficient for thin cuts over a widely dispersed area. When this is not inherent in the piece, it is often created by grinding a number of pieces in a load, or by recessing the surface to be ground.

If the requirement is only for flatness, and the cut is light, the work may be held against the belt by hand pressure. This is sound and practical within its range, but it has limitations in that no dimensional accuracy is provided, hand pressure is inadequate for any but very light cuts, and the abrasive may not be used as fully as it could be with more pressure. Consequently, mechanical means for applying the work to the belt and for oscillating it to use the full width of the belt are provided in some machines.

In grinding diameters, a contact roll is generally used behind the belt, and the work is controlled and fed by a centerless-type regulating wheel, or it is mounted on centers and rotated during grinding. In either case, the width of the abrasive and its superior sharpness in belt form are relied upon to provide speed and efficiency.

Since the contact roll itself never comes in contact with the work, it holds its diameter, trueness, and balance for a long time. A variety of contact rolls may be used, and over any roll the change from one belt to another of any desired grit takes little time.

For polishing, and for the grinding preceding polishing, a contact roll is generally used behind the belt. However, some kinds of work are polished over a resilient platen, or against the span of the belt with no support behind it. Polishing is nearly always a dry operation, while platen grinding is more often done with coolant.

The abrasive grains are very strongly bonded to the belts, well buttressed with cement, and stand up sharp and strong. The belts are usually about three times as long as the circumference of the compar-

Presented at Annual Meeting, American Society of Tool Engineers, March 17, 1951.

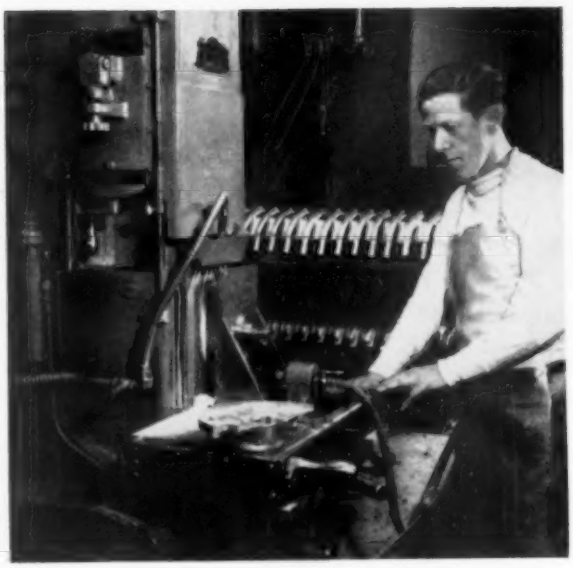


Fig. 1. A belt grinder making a light cut over a widely-dispersed area.

able polishing wheel. They run cool because they are exposed to air on both sides during a good part of their revolution, and rid themselves of work particles as they bend and straighten twice in each circuit around the pulleys.

Belts and Abrasives: The cloth backing of the belt has a slight degree of resilience. This makes the abrasive "flow" smoothly over the work, cutting all the way. It also allows the abrasive to slope back slightly. As it becomes dull, and more pressure is applied, the cutting edge tends to rise up or the rear edge to press down and keep on cutting sharply.

In platen grinding, where the whole area is ground at once, the common practice is to use silicon carbide abrasive for about everything but steel, and sometimes even for that. It cuts with less pressure, creates less heat, and generally keeps itself sharp by fracturing more readily than aluminum oxide.

In contact roll grinding, where the grinding area is a narrow band across the wheel, aluminum oxide abrasive is more generally used for all kinds of metal, except on final coloring operations. Higher abrasive speeds are used than in platen grinding.

Abrasive-Belt Mechanical Grinding

In the simplest type of mechanical grinding, where the requirement is mainly to skim off one side flat, a vertical-horizontal dry platen grinder is used.

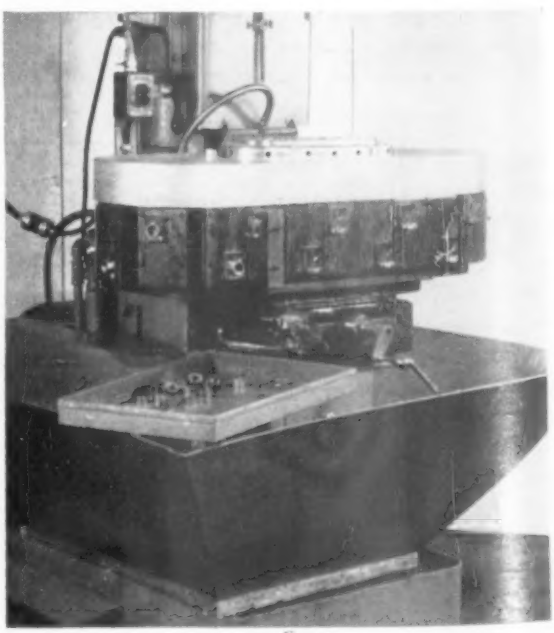
When the requirement is to grind to a certain thickness, parallelism, or in particular relation to other parts of the piece, or where the stock removal is greater than can readily be accomplished by hand pressure, or where a number of pieces can be ground in a load, a heavier machine with a table is required as shown in Fig. 1, grinding the first surface of an aluminum die-casting. This piece is about 6 x 11 in. overall, and is an example of what this type of belt grinding does best, a light cut over a widely dispersed area. It was formerly milled, and the standard time was 37 pieces per hour. The production rate of 125 pieces per hour on the belt grinder is three times faster. Actually the operator can readily grind 180 per hour.

Many examples can be given where the production for work of this class ranges from 300 to 400 pieces an hour. One such example is a fixtured operation on a Permold aluminum saw handle, grinding a 1-in. diameter single boss down to thickness and parallelism from the rear side. The fixture is a simple backstop bar parallel to the platen. The operator ground 13 pieces in one minute, box to box, or at the rate of 780 per hour. This is plunge grinding, without oscillation.

On the same type of machine, a rubber-covered pulley about 7 in. in diameter by 8 in. in length was ground. The platen of the machine was replaced by a steel backing roll, since there was only line contact. The work was held on an arbor mounted in a motor-driven lathe-type fixture. Two arbors were provided, one to be loaded while the other was plunge grinding.

Fig. 2 shows the same basic type of machine equipped with an automatic feeder. It has 21 carriers, and after each one passes the leading edge of the belt it is advanced squarely toward the surface of the belt by four cams, one for each corner of the carrier. The backing plates of the work holders can be ground in position, so that uniformity and parallelism are obtainable. Two carriers are against the belt at all times, and frequently two to four small pieces are mounted on each carrier. The carrier

Fig. 2 shows a belt grinder equipped with an automatic feed.



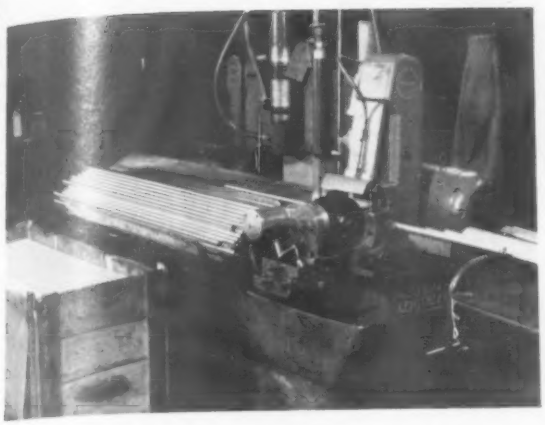


Fig. 3. Here a wet belt centerless grinder is producing a satin finish on aluminum tubing.

speeds are generally 720, 1090, 1350, or 1750 per hour, and some form of automatic ejector is employed so that the operator has only to load the carrier. Its applications are for small pieces where the stock removal can easily be accomplished in seven seconds or less, by a belt fine enough to give the desired finish.

Fig. 3 shows a wet belt centerless grinder. It has a conventional regulating roll, work rest blades, and change gears for a wide range of feeds. The material is aluminum tubing, 1 in. OD, run at 18 fpm, using #320 SiC abrasive belt with oil coolant, producing a fine satin finish. Belt life is 2250 ft of tubing. On ¾ in. diam. steel, a diameter reduction of 0.010 in. at 1½ fpm is about the potential of the 3-hp motor, using a #50 Aloxide abrasive belt. Rubber, vulcanite, plastic, and fibre usually run well, and at rapid feeds. It is frequently desirable to be able to change from one grit size to another in less than a minute, with only the cost of a new belt involved.

Abrasive-Belt Polishing

For general polishing, the back-stand type of machine is the basic and most versatile type of equipment.

In this type of machine, it must be emphasized the belt is not just another form of abrasive that is separate from the wheel. Rather, the belt opens up a whole area of new and more effective polishing in which much more can be done with the abrasive. The belt is three times as long as the wheel circumference; it stays cool, flings off metal particles, cuts faster, and causes less than one-third of the non-productive time lost.

When the work has a fixed contour which must be repeated over and over in quantity, a "formed-contact-wheel grinder", such as shown in Fig. 4, is indicated. Here the belt runs vertically, and the formed roll behind a nearly straight reach of the belt can form it laterally to a greater degree than is possible in the back-stand arrangement.

Table I—Typical Production in Abrasive-Belt Grinding

Part	Material	Size	Operation	Belt	Production	Belt life hours
Fuse*	D. C. Alum.	1 in. diam 3 in. long	Grind 2 ends	※60 SiC greased	1000/hr.	16
Fuse Striker*	"	¾ in. diam 2 in. long	Grind 2 ends	※60 SiC greased	800/hr.	40
Towel bar Bracket*	"	1½ in. diamond	Grind base	※60 SiC greased	900/hr.	40
Flange & Boss*	"	2 in. square 1¼ in. boss	Edge & Rd. corners Boss top	※80 SiC greased	300/hr.	8
Cover W. S. Wiper*	D. C. Zinc	¾ × 4 in Rect.	Grind base	※60 SiC dry	2000/hr.	8
Vapor-tite Condulet※	Cast iron	5×12 in. hollow	Flat to 0.0015 in.	※40 Alox dry	48/hr.	2
"※	"	3×9 in. hollow	"	"	90/hr.	2
"※	"	6×15 in. hollow	"	"	25/hr.	2

*By courtesy of Precision Die Castings Co.
※By courtesy of Crouse-Hinds Co.

In the application illustrated, stainless steel cooking pans have been heavily copper plated on the bottom for good heat conduction. The copper is rough, and the problem is to produce a good finish on the bottom and about 1½ in. on the sides. The pans are held on a motor-driven appliance, and plunge cut against the belt over the formed roll. The net grinding time, not including loading, is about 7 to 15 seconds according to the size of the pan and roughness of the copper plating. Kerosene is applied to the belt before starting it, and grease is applied at intervals during operation.

This method is applicable to many other types of work: hand-held, supported by a rest, revolved by a flexible shaft, spinner, or indexing work head. When the work becomes highly irregular, as in grinding the parting lines from plastic stocking forms, recourse must be had to strapping on the free belt, or over a resilient platen.

Fig. 4. Cooking pans with copper-plated bottoms are shown here being ground and finished on a back-stand type of machine.

Screw Thread Standards for Federal Service

SCREW THREAD PRODUCT LIMITS

NOMINAL SIZE PITCH & SYMBOL	BOLTS & SCREWS RING THREAD GAGES						BASIC P. D.	NUTS & TAPPED HOLES PLUG THREAD GAGES					
	1A	2A	3A	1	2	3		1B	2B	3B	1	2	3
# 0 (.060) - 80 NF		.0514 .0496		.0512 .0488	.0519 .0502	.0519 .0506	.0519		.0519 .0542		.0519 .0543	.0519 .0536	.0519 .0532
# 1 (.073) - 64 NC		.0623 .0603		0622 .0596	.0629 .0610	.0629 .0615	.0629		.0629 .0645		.0629 .0655	.0629 .0648	.0629 .0643
# 1 (.073) - 72 NF		.0634 .0615		.0633 .0608	.0640 .0622	.0640 .0627	.0640		.0640 .0665		.0640 .0665	.0640 .0658	.0640 .0653
# 2 (.086) - 56 NC		.0738 .0717		.0736 .0708	.0744 .0724	.0744 .0729	.0744		.0744 .0771		.0744 .0772	.0744 .0764	.0744 .0759
# 2 (.086) - 64 NF		.0753 .0733		.0752 .0726	.0759 .0740	.0759 .0745	.0759		.0759 .0785		.0759 .0785	.0759 .0778	.0759 .0773
# 3 (.099) - 48 NC		.0848 .0825		.0846 .0815	.0855 .0833	.0855 .0839	.0855		.0855 .0885		.0855 .0886	.0855 .0877	.0855 .0871
# 3 (.099) - 56 NF		.0867 .0845		.0856 .0838	.0874 .0854	.0874 .0859	.0874		.0874 .0903		.0874 .0902	.0874 .0894	.0874 .0889
# 4 (.112) - 40 NC		.0950 .0925		.0948 .0914	.0958 .0934	.0958 .0941	.0958		.0958 .0991		.0958 .0992	.0958 .0982	.0958 .0975
# 4 (.112) - 48 NF		.0978 .0954		.0976 .0945	.0985 .0963	.0985 .0969	.0985		.0985 .1016		.0985 .1016	.0985 .1007	.0985 .1001
# 5 (.125) - 40 NC		.1080 .1054		.1078 .1044	.1088 .1064	.1088 .1071	.1088		.1088 .1122		.1088 .1122	.1088 .1112	.1088 .1105
# 5 (.125) - 44 NF		.1095 .1070		.1093 .1061	.1102 .1079	.1102 .1086	.1102		.1102 .1135		.1102 .1134	.1102 .1125	.1102 .1118
# 6 (.138) - 32 NC		.1169 .1141		.1166 .1128	.1177 .1150	.1177 .1158	.1177		.1177 .1213		.1177 .1215	.1177 .1204	.1177 .1196
# 6 (.138) - 40 NF		.1210 .1184		.1208 .1174	.1218 .1194	.1218 .1201	.1218		.1218 .1252		.1218 .1252	.1218 .1242	.1218 .1235
# 8 (.164) - 32 NC		.1428 .1399		.1426 .1388	.1437 .1410	.1437 .1418	.1437		.1437 .1475		.1437 .1475	.1437 .1464	.1437 .1456
# 8 (.164) - 36 NF		.1452 .1424		.1449 .1413	.1460 .1435	.1460 .1442	.1460		.1460 .1496		.1460 .1496	.1460 .1485	.1460 .1478
# 10 (.190) - 24 NC		.1619 .1586		.1616 .1570	.1629 .1596	.1629 .1605	.1629		.1629 .1672		.1629 .1675	.1629 .1662	.1629 .1653
# 10 (.190) - 32 NF		.1688 .1658		.1686 .1648	.1697 .1670	.1697 .1678	.1697		.1697 .1736		.1697 .1735	.1697 .1724	.1697 .1716
# 12 (.216) - 24 NC		.1879 .1845		.1876 .1830	.1889 .1856	.1889 .1865	.1889		.1889 .1933		.1889 .1935	.1889 .1922	.1889 .1913
# 12 (.216) - 28 NF		.1918 .1886		.1916 .1873	.1928 .1897	.1928 .1906	.1928		.1928 .1970		.1928 .1971	.1928 .1959	.1928 .1950
1/4" - 20 UNC	.2164 .2108	.2164 .2127	.2175 .2147	.2160 .2109	.2175 .2139	.2175 .2149	.2175	.2175 .2248	.2175 .2223	.2175 .2211	.2175 .2226	.2175 .2211	.2175 .2201
1/4" - 28 UNF	.2258 .2208	.2258 .2225	.2268 .2243	.2256 .2213	.2268 .2237	.2268 .2246	.2268	.2268 .2333	.2268 .2311	.2268 .2300	.2268 .2311	.2268 .2299	.2268 .2290
5/16" - 18 UNC	.2752 .2691	.2752 .2712	.2764 .2734	.2748 .2691	.2764 .2723	.2764 .2734	.2764	.2764 .2843	.2764 .2817	.2764 .2803	.2764 .2821	.2764 .2805	.2764 .2794
5/16" - 24 UNF	.2843 .2788	.2843 .2806	.2854 .2827	.2841 .2795	.2854 .2821	.2854 .2830	.2854	.2854 .2925	.2854 .2902	.2854 .2890	.2854 .2900	.2854 .2887	.2854 .2878
3/8" - 16 UNC	.3331 .3266	.3331 .3287	.3344 .3311	.3326 .3263	.3344 .3299	.3344 .3312	.3344	.3344 .3429	.3344 .3401	.3344 .3387	.3344 .3407	.3344 .3389	.3344 .3376
3/8" - 24 UNF	.3468 .3411	.3468 .3430	.3479 .3450	.3466 .3420	.3479 .3446	.3479 .3455	.3479	.3479 .3553	.3479 .3528	.3479 .3516	.3479 .3525	.3479 .3512	.3479 .3503
7/16" - 14 UNC	.3897 .3826	.3897 .3850	.3911 .3876	.3890 .3820	.3911 .3862	.3911 .3875	.3911	.3911 .4003	.3911 .3972	.3911 .3957	.3911 .3981	.3911 .3960	.3911 .3947
7/16" - 20 UNF	.4037 .3975	.4037 .3995	.4050 .4019	.4035 .3984	.4050 .4014	.4050 .4024	.4050	.4050 .4131	.4050 .4104	.4050 .4091	.4050 .4101	.4050 .4086	.4050 .4076

Screw Thread Standards for Federal Service

(Continued)

NOMINAL SIZE PITCH & SYMBOL	RING THREAD GAGES BOLTS & SCREWS						BASIC P. D.	NUTS & TAPPED HOLES PLUG THREAD GAGES					
	1A	2A	3A	1	2	3		1B	2B	3B	1	2	3
1/2" - 13 NC	.4485 .4411	.4485 .4435	.4500 .4463	.4478 .4404	.4500 .4448	.4500 .4463	.4500	.4500 .4597	.4500 .4565	.4500 .4548	.4500 .4574	.4500 .4552	.4500 .4537
1/2" - 12 UNC	.4444 .4367	.4444 .4393	.4459 .4421	.4435 .4358	.4459 .4403	.4459 .4419	.4459	.4459 .4559	.4459 .4525	.4459 .4509	.4459 .4536	.4459 .4515	.4459 .4499
1/2" - 20 UNF	.4662 .4598	.4662 .4619	.4675 .4643	.4660 .4609	.4675 .4639	.4675 .4649	.4675	.4675 .4759	.4675 .4731	.4675 .4717	.4675 .4726	.4675 .4711	.4675 .4701
9/16" - 12 UNC	.5068 .4990	.5068 .5016	.5084 .5045	.5060 .4981	.5084 .5028	.5084 .5044	.5084	.5084 .5186	.5084 .5152	.5084 .5135	.5084 .5163	.5084 .5140	.5084 .5124
9/16" - 18 UNF	.5250 .5182	.5250 .5205	.5264 .5230	.5248 .5191	.5264 .5223	.5264 .5234	.5264	.5264 .5353	.5264 .5323	.5264 .5308	.5264 .5321	.5264 .5305	.5264 .5294
5/8" - 11 UNC	.5644 .5561	.5644 .5589	.5660 .5619	.5634 .5549	.5660 .5601	.5660 .5618	.5660	.5660 .5767	.5660 .5732	.5660 .5714	.5660 .5745	.5660 .5719	.5660 .5702
5/8" - 18 UNF	.5875 .5805	.5875 .5828	.5889 .5854	.5873 .5816	.5889 .5848	.5889 .5859	.5889	.5889 .5980	.5889 .5949	.5889 .5934	.5889 .5946	5889 .5930	.5889 .5919
3/4" - 10 UNC	.6832 .6744	.6832 .6773	.6850 .6806	.6822 .6730	.6850 .6786	.6850 .6805	.6850	.6850 .6965	.6850 .6927	.6850 .6907	.6850 .6942	.6850 .6914	.6850 .6895
3/4" - 16 UNF	.7079 .7004	.7079 .7029	.7094 .7056	.7076 .7013	.7094 .7049	.7094 .7062	.7094	.7094 .7192	.7094 .7159	.7094 .7143	.7094 .7157	.7094 .7139	.7094 .7126
7/8" - 9 UNC	.8009 .7914	.8009 .7946	.8028 .7981	.7997 .7897	.8028 .7958	.8028 .7979	.8028	.8028 .8151	.8028 .8110	.8028 .8089	.8028 .8128	.8028 .8098	.8028 .8077
7/8" - 14 UNF	.8270 .8189	.8270 .8216	.8286 .8245	.8265 .8195	.8286 .8237	.8286 .8250	.8286	.8286 .8392	.8286 .8356	.8286 .8339	.8286 .8356	.8286 .8335	.8286 .8322
1" - 8 UNC	.9168 .9067	.9168 .9100	.9188 .9137	.9154 .9043	.9188 .9112	.9188 .9134	.9188	.9188 .9320	.9188 .9276	.9188 .9254	.9188 .9299	.9188 .9264	.9188 .9242
1" - 12 UNF	.9441 .9353	.9441 .9382	.9459 .9415	.9435 .9356	.9459 .9403	.9459 .9419	.9459	.9459 .9573	.9459 .9535	.9459 .9516	.9459 .9538	.9459 .9515	.9459 .9499
1" - 14 NF	.9519 .9435	.9519 .9463	.9536 .9494	.9515 .9445	.9536 .9487	.9536 .9500	.9536	.9536 .9645	.9536 .9609	.9536 .9590	.9536 .9606	.9536 .9585	.9536 .9572
1 1/8" - 7 UNC	1.0300 1.0191	1.0300 1.0228	1.0322 1.0268	1.0283 1.0159	1.0322 1.0237	1.0322 1.0263	1.0322	1.0322 1.0463	1.0322 1.0416	1.0322 1.0393	1.0322 1.0446	1.0322 1.0407	1.0322 1.0381
1 1/8" - 12 UNF	1.0691 1.0601	1.0691 1.0631	1.0709 1.0664	1.0685 1.0606	1.0709 1.0653	1.0709 1.0669	1.0709	1.0709 1.0826	1.0709 1.0787	1.0709 1.0768	1.0709 1.0788	1.0709 1.0765	1.0709 1.0749
1 1/4" - 7 UNC	1.1550 1.1439	1.1550 1.1476	1.1572 1.1517	1.1533 1.1409	1.1572 1.1487	1.1572 1.1513	1.1572	1.1572 1.1716	1.1572 1.1668	1.1572 1.1644	1.1572 1.1696	1.1572 1.1657	1.1572 1.1631
1 1/4" - 12 UNF	1.1941 1.1849	1.1941 1.1879	1.1959 1.1913	1.1935 1.1856	1.1959 1.1903	1.1959 1.1919	1.1959	1.1959 1.2079	1.1959 1.2039	1.1959 1.2019	1.1959 1.2038	1.1959 1.2015	1.1959 1.1999
1 3/8" - 6 UNC	1.2643 1.2523	1.2643 1.2563	1.2667 1.2607	1.2623 1.2478	1.2667 1.2566	1.2667 1.2596	1.2667	1.2667 1.2822	1.2667 1.2771	1.2667 1.2745	1.2667 1.2812	1.2667 1.2768	1.2667 1.2738
1 3/8" - 12 UNF	1.3190 1.3096	1.3190 1.3127	1.3209 1.3162	1.3185 1.3106	1.3209 1.3153	1.3209 1.3169	1.3209	1.3209 1.3332	1.3209 1.3291	1.3209 1.3270	1.3209 1.3288	1.3209 1.3265	1.3209 1.3249
1 1/2" - 6 UNC	1.3893 1.3772	1.3893 1.3812	1.3917 1.3856	1.3873 1.3728	1.3917 1.3816	1.3917 1.3846	1.3917	1.3917 1.4075	1.3917 1.4022	1.3917 1.3996	1.3917 1.4062	1.3917 1.4018	1.3917 1.3988
1 1/2" - 12 UNF	1.4440 1.4344	1.4440 1.4376	1.4459 1.4411	1.4435 1.4356	1.4459 1.4403	1.4459 1.4419	1.4459	1.4459 1.4584	1.4459 1.4542	1.4459 1.4522	1.4459 1.4538	1.4459 1.4515	1.4459 1.4499

Classes 1B, 2B, 3B, 1A, 2A, 3A are not unified in sizes smaller than 1/4", although classes 2B and 2A are acceptable in the U.S.

The unified system does not supersede the American Standard, but becomes a part of it. Present class 1, 2 and 3, are retained in the American Standard because of their widespread use.

WORKING PLUG GAGES Go Working Thread Plug Gages of all classes are basic. For those who desire to use Unified Classes 1B, 2B, or 3B, it will be necessary to order No Go Plugs of these classes.

SETTING PLUG GAGES Go Set Plugs, Class 1A and 2A are new. The same set plug is common to both classes. Class 3A Go Set Plug is basic, as are classes 2 and 3. No Go Set Plugs, Classes 1A, 2A and 3A are new. Classes 2 and 3 remain the same.

RING GAGES Go Rings, Classes 1A and 2A are new. Class 3A is basic as are classes 2 and 3. No Go Rings, Classes 1A, 2A and 3A are new. Classes 2 and 3 remain the same.

—Courtesy Republic Gage Co.

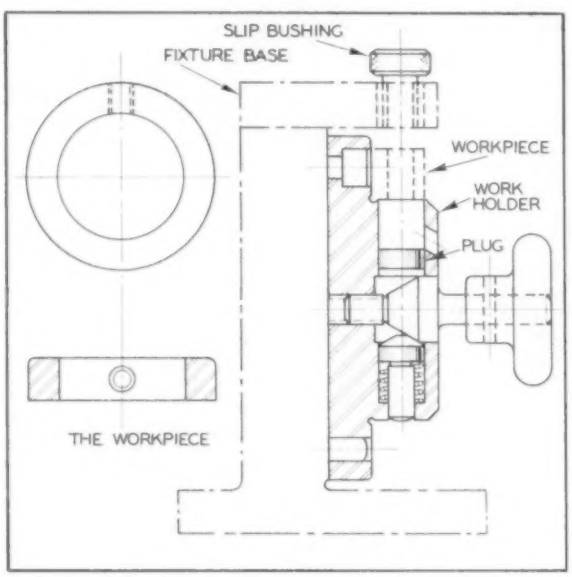
Gadgets

Ingenious Devices and Ideas to Help the Tool Engineer in His Daily Work

Versatile Fixture Component

While the fixture component shown in solid lines was originally used on an automatic drilling machine to drill and tap holes on the periphery of a ring—here shown with only one hole—it suggests various applications in addition to the one illustrated.

The body of the component serves as a locating plug for the workpiece. The clamping, which is at once fast and rather novel in principle, consists of conical plunger which, in turn, is moved outward against the I.D. of the workpiece by a tapered screw plug. Retraction is effected by a compression spring.



A fixture component, such as shown, can be variously adapted to drill jigs for drilling single or multiple holes on rings.

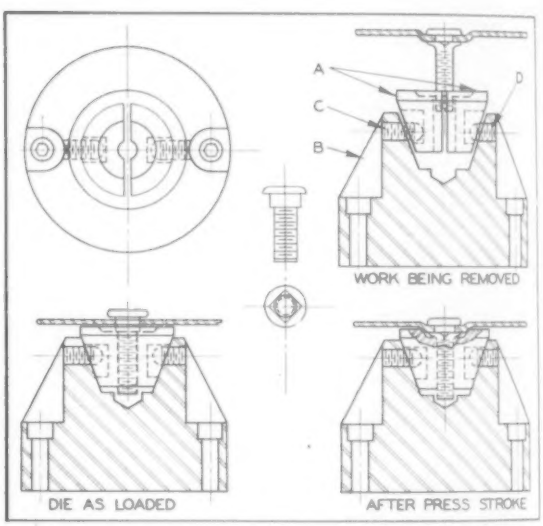
As here shown installed on a fixture base mounting a bushing plate—broken lines—the part is located in the component plug, then clamped. The hole is then drilled through a slip bushing, which is removed for tapping. Should it be required to drill several holes—say three equally spaced, for example—the conical plunger could incorporate a shouldered locator on its small diameter, to engage a previously drilled hole as the plunger is expanded. Naturally, the latter would then be located 120 deg from the bushing center, or 90 deg if used to drill 4 holes.

Robert Mawson
Providence, R. I.

Upsetting Die

In tooling up to attach square shouldered bolts in sheet metal by upsetting the corners of the square section of the bolts, it was necessary to develop a die which would tightly secure the round portion while the bolt head was hit in the punch press. A further requirement was that the die release the bolt easily for removal under fast production conditions.

As the "gadget" shown met these conditions to our complete satisfaction, has been proven desirable and may further be modified to suit other applications, I submit it for consideration by other "gadgeteers."



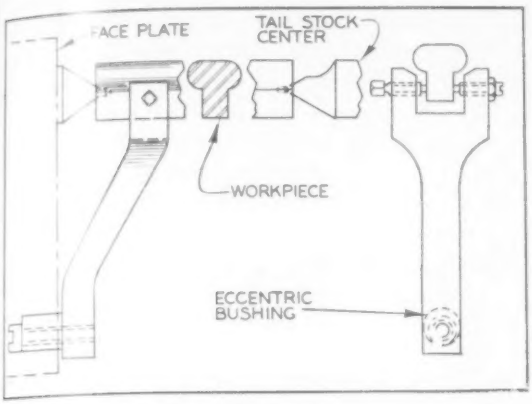
Tapered grips, wedging with the die body on the down stroke of a punch press, hold a bolt securely and release on up stroke of the ram.

Parts A, which grip the bolt, are tapered as shown and loosely secured in the die block by screws C and D, the latter riding in grooves in parts A. On the down stroke of the press, these members wedge tightly together in the die block and hold the bolt securely. On the up stroke, when the sheet metal and bolt assembly are lifted, the gripping members rise and spread to release the bolt.

Charles E. Hayward
Western Michigan Chapter

The Tool Engineer pays regular page rates for accepted contributions to these pages, with a minimum of $5.00 for each item.

Dog for Odd-Shaped Work



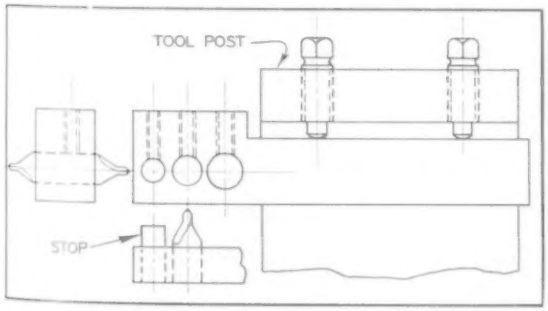
A dog, such as illustrated, serves to hold odd-shaped work without need of extra length for dogging.

The dog shown can be used with a dividing head and tailstock on the shaper, milling machine or grinder to machine the surfaces of punches and other parts having odd-shaped cross sections without an additional length being required for dogging. While the dog shown was made to hold a special shape in one plant, the idea is applicable to other asymmetrical workpieces.

Wesley Prince
Member-at-Large

Center Drill Holder

While it is customary to hold a center drill in a tailstock chuck, when centering work in a lathe, we have found that the tool shown speeds centering operations, especially so when used with a turret tool post. When so applied, the tool can be used without packing blocks and the bores will be in line with the headstock center. If used with a rocker-type tool post, it must be adjusted for each setup.



The center drill holder shown is designed for use with a turret tool post and is a time saver on repetitive center-drilling.

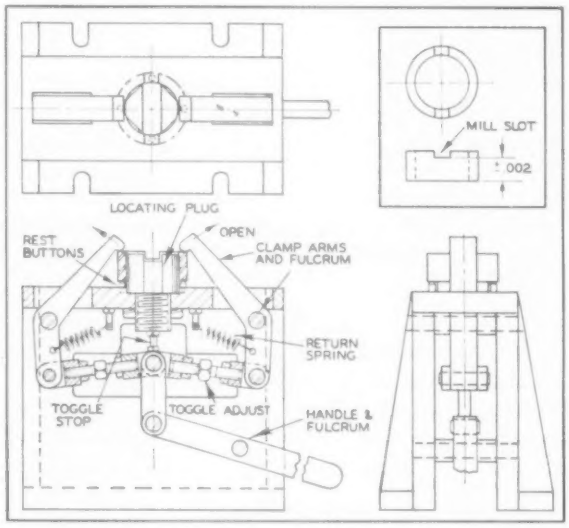
The tool is made from a length of mild steel bar and of a height to suit the tool post opening. The shoulder shown may or may not be necessary, depending on the amount of stock required for tapping the set screw holes. The bar is held in the tool post and, with center drills of the desired size held in the headstock chuck, is first center drilled and then drilled and reamed to suit the diameter of several center drills. There should be about 1/8 in. wall between the holes.

The tool holder can be quickly set up in the tool post and adequately aligned at any time, and drilling to repetitive depths can be easily accomplished by means of stops. The shank should be case hardened if used for continuous service.

Ian J. Peacock
Carlisle, Britain

Toggle Milling Fixture

It was required to mill a slot in a ring, as shown in the inset. The distance from the bottom of the slot to the bottom of the part had to be held within 0.002 in., and volume demanded fast loading and unloading. All of these requirements were met by the milling fixture here shown. The drawing is schematic and excludes all but the locating and clamping elements.



Equalizing toggle clamps, on a milling fixture, insure equalized clamping together with rapid loading and unloading.

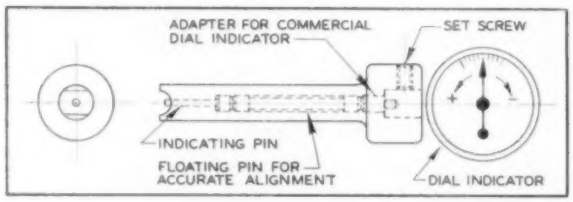
Clamping is accomplished by two toggle-actuated arms which move in and down on depressing the handle. The locating plug prevents the workpiece moving sideways and the clamps hold it firmly against the rest buttons.

By setting the toggle adjustment—which consists of a rod with a right and left-hand thread—the correct clamping pressure is obtained, while a toggle stop determines the proper lock point. Return springs open the arms individually, and because of a floating link between the handle and toggle arms, equal pressure is applied by each clamp arm regardless of surface irregularities.

Paul H. Winter
Syracuse Chapter

Inspection Gage

The inspection gage shown was designed to check the depth of a groove in relation to a cylindrical surface. Use of a floating rod, as indicated by the shading, eliminates friction on the sides and thus reduces load on the indicator. It also entails a lesser accuracy in construction since the hole for the indicating pin can be slightly off center without creating bind.



A floating rod, in an adapter for a dial indicator, provides for checking of grooves with a minimum of friction and loss of accuracy.

The floating pin is slightly smaller than the bore; as a result, the spring in the dial indicator can support the weight of the pin and floating rod. Thus, both the floating rod and the indicator pin can easily return to zero after the workpiece has been checked.

Anthony Gabriele
Brooklyn, N. Y.

Redesign for Brake Lever

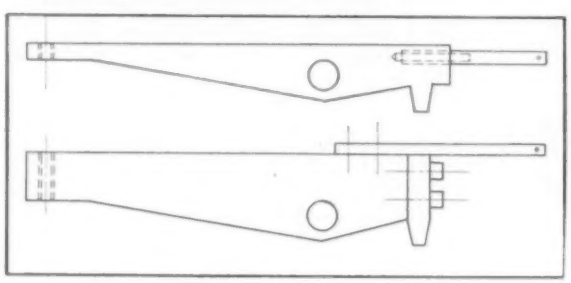
In our plant, the lug on the rapid traverse brake lever of a production lathe, shown in the upper illustration, would either wear to a point where it no longer engaged, or break off entirely. In the past, we repaired the lug by welding, but the results were unsatisfactory both because of time consumed and limited length of service of the repaired part. For another thing, a spring rod was screwed into the end of the lever, and this would crystalize and break off flush with the end of the lever.

The writer therefore redesigned the lever as shown in the lower illustration. The body of the lever was made ½ in. wider and the lug attached, as a separate component, by means of two screws. The spring rod, in turn, was made of a piece of flat stock and screwed to the top of the lever, thus entailing a slight lengthening of the spring.

The redesigned lever is much sturdier and has the advantage that, should the lug wear, it can be unscrewed and reversed to present a new side. If it breaks off entirely a new lug can be installed without removing the lever from the lathe.

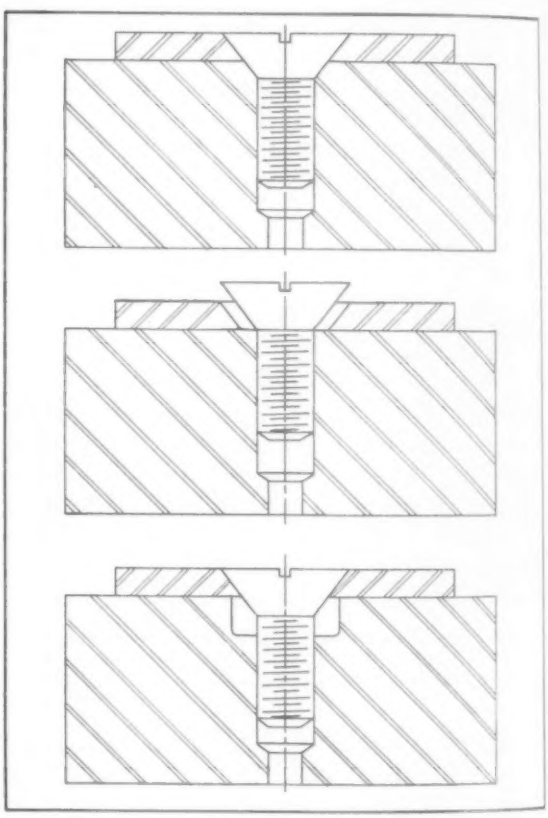
Frank M. Butrick, Jr.
Alma, Mich.

By redesigning a rapid-traverse brake lever and providing a replacement lug and spring bar as shown in the "before and after" drawing, service life has been extended and both lug and spring bar can be replaced without removing the lever from the lathe.



To Provide Screw Clearance

A rather common and also costly mistake, when designing or making dies that require frequent sharpening, is neglect to provide clearance under countersunk head screws, as indicated in the upper drawing. Then, when the die surface is sharpened, the screw extends over the top surface, as shown at center, necessitating further reworking or countersinking.



By counterboring as shown in lower illustration, screw heads will remain permanently flush with the top surface of dies despite repeated

All this can be entirely eliminated by adding a clearance counterbore, as shown in the lower illustration, when the die is originally built. The condition shown at center can never occur if this simple precaution is taken; rather, the die can be resharpened indefinitely with the screw head always flush with the top surface.

Cliff Bossman
Dayton, Ohio

TOOL ENGINEERING IN Action

Republic Aviation:

Fighters in Quantity

By **Gilbert P. Muir**

REPUBLIC AVIATION CORPORATION at Farmingdale, Long Island, New York, is a military aircraft builder best known for its World War II fighter-bomber, the P-47 Thunderbolt, and its postwar jet fighter-bomber, the F-84 Thunderjet. Both ships have made headlines; the P-47 is credited with destruction of some 7000 enemy aircraft, and the heavily-armed F-84 has piled up an impressive record in Korea.

Behind these war records lie tooling problems that are as complex as the insides of the aircraft they are associated with, and production requirements that would seem to obviate any possibility of applying tool engineering techniques.

The Industry

Republic's story is in many instances a study of the aircraft industry, although close parallels in this boom-or-bust industry are dangerous. The aircraft industry was definitely an underfed cousin of the mass transportation industries before the war, with a ranking around 43rd in size among American industries. During World War II it rushed to a 48-billion dollar volume, and under a high head of steam, plants, personnel, tooling and production mushroomed overnight. Thinking and planning were adjusted quickly to a frenzied attitude of expansion, and the push was for more and more ships. Republic during this time turned out more than 15,000 P-47 Thunderbolts.

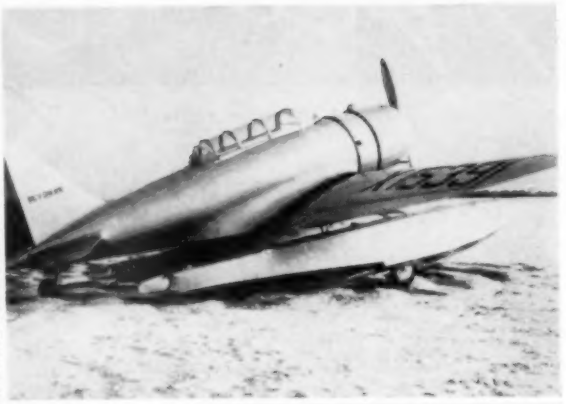
Then came the post-armistice cutback—a complete cutback for the aircraft industry. Republic, like many of the producers in the industry, had plans for the postwar era involving personal planes and entry into the commercial transport field. No producer hoped to maintain his wartime volume, but hopes were high for the personal plane field, and everyone believed that heavy wartime use of commercial airlines by businessmen and military personnel would lead to a great postwar expansion of the lines.

Republic's Mundy Peale, shown against a background of F-84E Thunderjet fuselage assemblies

Accordingly, Republic was ready to go after the war with a well-designed amphibian, the Seabee, as its entry in the personal plane field; and a commercial version of its fast, four-engined XR-12 for the airlines. Like many other aircraft producers, it found that the market for personal planes had been over-estimated; and wound up selling $16,000 worth of plane for about $6000. The commercial airlines' boom also failed to materialize—at least to the extent that new entrants such as Republic could not realize a profitable market.

Mundy I. Peale was elected president of Republic in 1947 with a lot of problems. Divesting the company of these unprofitable ventures was one pressing need; getting into production on Republic's new F-84 jet was another. He recalls that "all of us were so new in the jet fighter business that we didn't know what we were going to run into. Lots of the things we thought were going to be true because of our past experience were so brand new that they weren't true at all—so we had to learn to build a plane that was better to maintain and would be as good in service as it was as a performing airplane."

The intervening years before Korea provide a good idea of some of the basic difficulties in building and maintaining production of mili-



tary aircraft. First was the national uncertainty as to whether we were going to have an air force or whether we should forget the whole thing. In June, 1950, for example, the month that the Korean campaign started, Republic was laying off people because the company had run out of contracts. When the layoffs were stopped, it was not because new contracts were awarded but because Republic felt that they had to keep this skilled help on the payroll for the future. In addition, production planning under such handicaps at best leaves much to be desired.

Technical personnel has in recent years become an even greater problem. To quote Mundy Peale, "Engineers who at one time were good prospects were in effect told, either directly or through newspapers, that there was no future in aeronautical engineering. We have such cases as the fellow who quit us voluntarily to go out and sell ladies' handbags because he figured there was some future in it. Another fellow opened up a coal and ice yard on the Island because he wanted some security."

Republic has recently begun to reverse the trend, and, through intensified brush-up courses and on-the-job training, is making aeronautical engineers out of men with a wide variety of engineering backgrounds.

Designs and Tooling

Swinging from conventional aircraft to jet production has opened up a completely new portfolio of problems for tool engineers. Basically, jet aircraft designs have called for higher speeds, which make closer tolerances necessary. In addition,

(Left, from top to bottom) **Two of Republic's early all-metal military planes. Amphibian P-35 is at top. The P-43 Lancer, second from bottom, was first all-metal pursuit with semi-elliptical wings. Designed for high-altitude combat, it was supercharged. P-47 Thunderbolt at bottom won fame in World War II. First 400 mph plane, it destroyed 7,000 enemy aircraft. Over 15,000 Thunderbolts were built by Republic; record made Republic the world's largest producer of fighter aircraft.**

the higher speeds have required a plane which is smaller physically than conventional designs, but at the same time must carry considerably more equipment inside.

The results have been higher-content metals to withstand temperatures and corrosion; redesign of components to permit greater strength with less space and weight; development of new methods of fabrication and assembly. Republic's optical tooling system (*The Tool Engineer*, November, 1950), which shortly will be in use on a full production scale, is one of the developments in the latter category.

As one of the many part redesigns which have called for new production techniques, Republic cites the conventional practice of building wing spars from many extrusions and sheetmetal assemblies. The buildup of tolerances in such an assembly proved too great for the requirements, and the answer, shortly to go into production—a solid forging for the spar which will be over fifteen feet long and will be machined to finish dimensions.

Tooling vs Cost

Uncertain production requirements for military aircraft naturally wreck havoc with tooling plans. With a competitive cost factor in mind, the idea is to plan in the first place for tooling which will last the life of the program, once the model is in actual production.

With that in mind, Republic engineers work according to a basic three-point routine: First, an attempt to forecast total production demand and base tooling plans on that figure. Second, when additional contracts are received, tooling is reviewed for additional expected life, and then simultaneous with this a long-term tooling program is established which develops permanent tooling for the plane. Intermediate tooling is, of course, expensive, but with production requirements not known generally until some time after the plane is in production, it is hard to justify permanent tooling at the outset.

First production models of a new ship call for parts quantities that are very small to an industry whose

TOOL ENGINEERING IN Action

...tion quantities are trifling to ... mass production industries. ...s explained by what the air- ...industry refers to as the "80 ...t curve." Basically, the first ...nits require the greatest num- ...f work hours for completion. ...roduction doubles, the total ...er of man-hours is reduced by ...ercent, so that the 100th plane ...is 80 percent of the 50th in ... of man-hours required. Thus ...irst models can cost five to ... times more than later planes.

Organization

...separation of the thinking from ...doing is the key to Republic's ...ical organization breakdown. ...'thinking' side, under the chief ...engineer, includes the standards, ... design and manufacturing re- ...ch activities which comprise Re- ...lic's tool engineering. The factory ...erintendent heads production in ...mbly, parts and hangar opera- ...

...anufacturing standards here is ...lanning center which includes ...e top operations: manufacturing ...thods, time study, and plant lay- ... and equipment. The combined ...rations have the responsibility of ...eloping methods, providing space ... equipment and scheduling pro- ...tion, delivery and assembly of ... more than 165,000 parts which ...into a jet fighter.

...Methods operation begins with its ...neering department liason, to ...re that engineering designs are ...ctical from a production stand- ...nt. Drawings come to methods ...neering from the engineering de- ...tment for preliminary manufac- ...ing breakdown, to determine how ... plane will be sub-divided for ...duction. Major fixture require- ...nts are visualized, then details are ...rked out for subassembly ma- ...ial to insure fitting of parts into ... overall assembly pattern. After ... major plan has been established, ...ups are created within the meth- ...s engineering department to co- ...dinate work on the various major ...semblies. For example, a group ...ll be assigned to wing assemblies, ...nother to the fuselage.

...Methods processing begins, on re- ceipt of design engineering drawing releases, with development of operations sheet which spell out specifically all operations in detail. Subassembly requirements are estimated, and plans are established for production of detail parts.

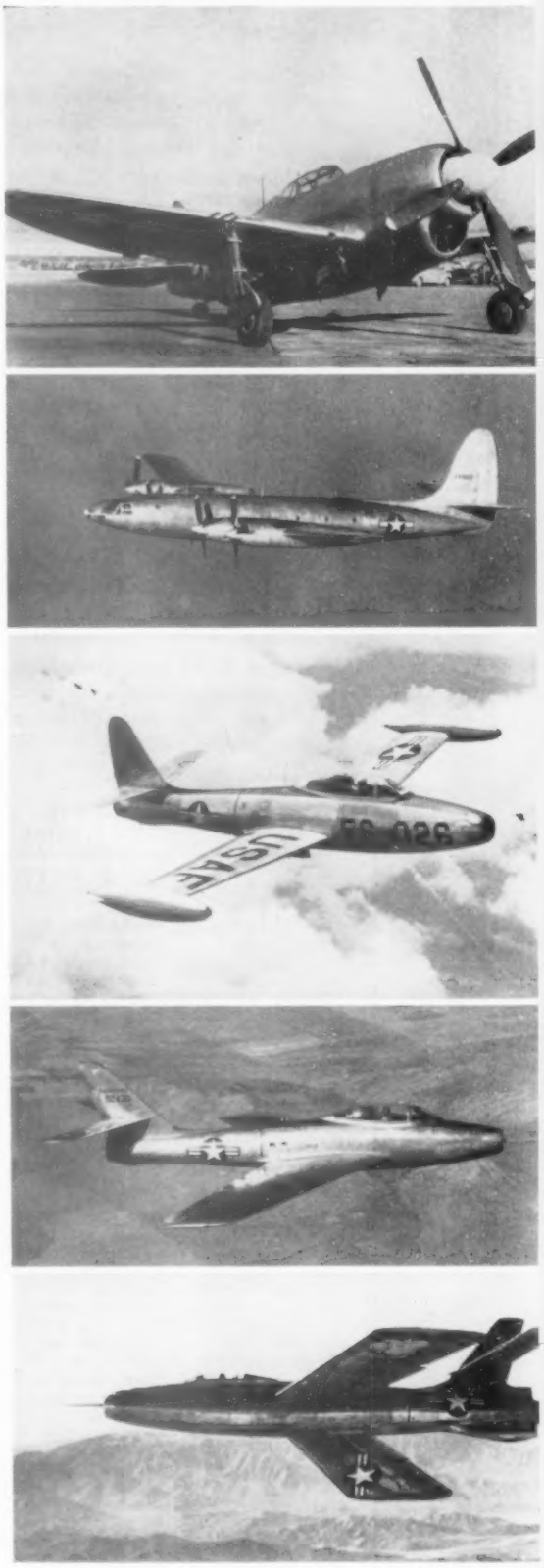
We now have reached the stage of sequencing, or planning by days and man-hours the time required to develop, manufacture and coordinate tools and assembly parts and subassemblies for final plane assembly. Starting from the delivery date of the plane, all operations are planned backwards to determine starting date on each phase, and including in the sequencing time where needed to establish parts banks. The priority sequence chart shown on gatefold, which will be explained later, indicates the pattern followed.

Tool orders can now be released to the tool shop, with record cards on each kept on hand for follow-up. Orders are sequenced to assure completion by a specified number of days before actual use.

Master Tooling

In the development of tools for processing and assembly, recognition must be given to the fact that various subcontractors of Republic will be performing operations identical to those scheduled at Farmingdale. Therefore, to insure complete interchangeability, Republic uses master tools, or tools from which actual working tools are made.

Master tools cover major items in plane assembly, and in some instances where there are a number of subcontractors, up to three sets of master tools are provided in addition to a master-master tool to govern production of the master.



(Right, from top to bottom) **P-47J, first plane to exceed 500 mph in level flight, still holds record for conventional planes. XR-12 was world's fastest four-engine plane (450 mph) when built. F-84E, 600 mph-plus fighter-bomber, earned spurs in Korea. Newer F-84F outperforms 'E' in speed, climb, ceiling and armanent. Powered by 7200-lb-thrust engine. XF-91 at bottom is high-speed, high altitude interceptor powered by jet and rocket. Angle of radical inverse-taper wing is changeable in flight.**

Sequencing

Scheduling of detail parts, subassemblies, major assemblies and final assembly is accomplished with the aid of the Priority Sequence Chart, shown on the gatefold, which indicates the following:

1. Date on which engineering releases are expected.
2. Time allowed for methods analysis and flow time
3. Tool design and manufacturing flow
4. Manufacture of detail parts
5. Subassembly flow time
6. Major assembly flow time
7. Final assembly
8. Date plane goes out the door
9. Required hangar time before delivery to Air Force.

The Priority Sequence Chart is the master plan for plane production. After it has been established on the basis of overall time required for each of the parts and assemblies shown, operations sheets, machine loading charts, time study planning and subcontract scheduling are developed.

Scheduling Operations

Key to the individual operations involved in airplane assembly is the operations flow chart, detailing the time and manpower required for every operation on the ship. Time study data naturally forms a substantial basis for such a complete detailing of time and personnel, and the development of these charts in itself provides for more effective control of the tremendous number of assembly and inspection operations involved.

Aside from controlling the individual operations, the chart enables Republic's engineers to vary time and personnel to meet specific situations. Each operation is plotted horizontally in terms of number of standard hours required for the operation, and vertically to indicate number of workers (two spaces per worker). If production is to be increased, and four planes per day is the requirement, production is scheduled for one completed plane every four hours based on 2 8-hour shifts. Therefore an adjustment to the material flow chart must be made. The flow chart will reflect a shorter period for completion per unit, and material and parts must be made available for the new rate of assembly flow at the appropriate station.

In addition, the listing of functions and required time permits ready evaluation of minimum number of workers needed. As can be seen on the sample operations flow chart, the worker and inspection crew move over several stations on the same ship, complete these inspections, then move to the same station on the next plane.

Time Study

It can be seen that time study forms an important part of the complete planning throughout plane production. Time study is also responsible for scheduling parts to the station when needed, so inventory and machine loading form a substantial part of the operation.

Machine loading is tied into the overall planning scheme through se-

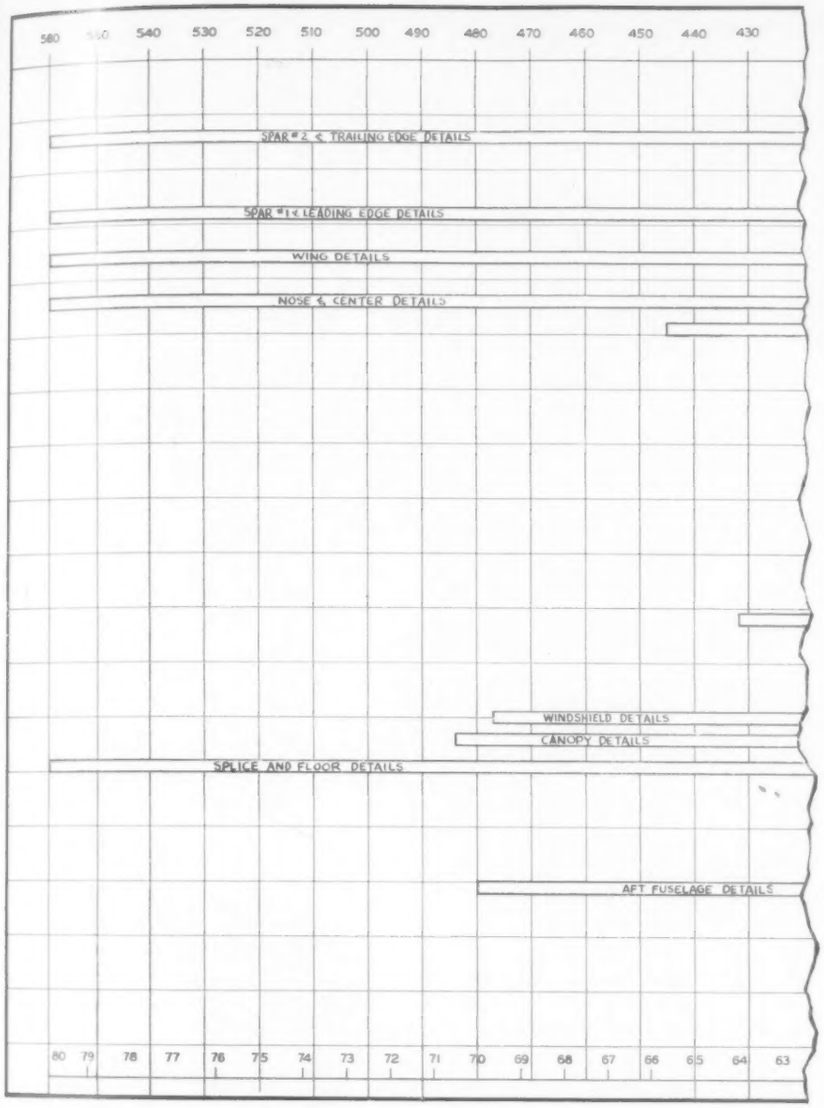
TOOLING REQUIRED FOR FORWARD FUSELAGE, NOSE

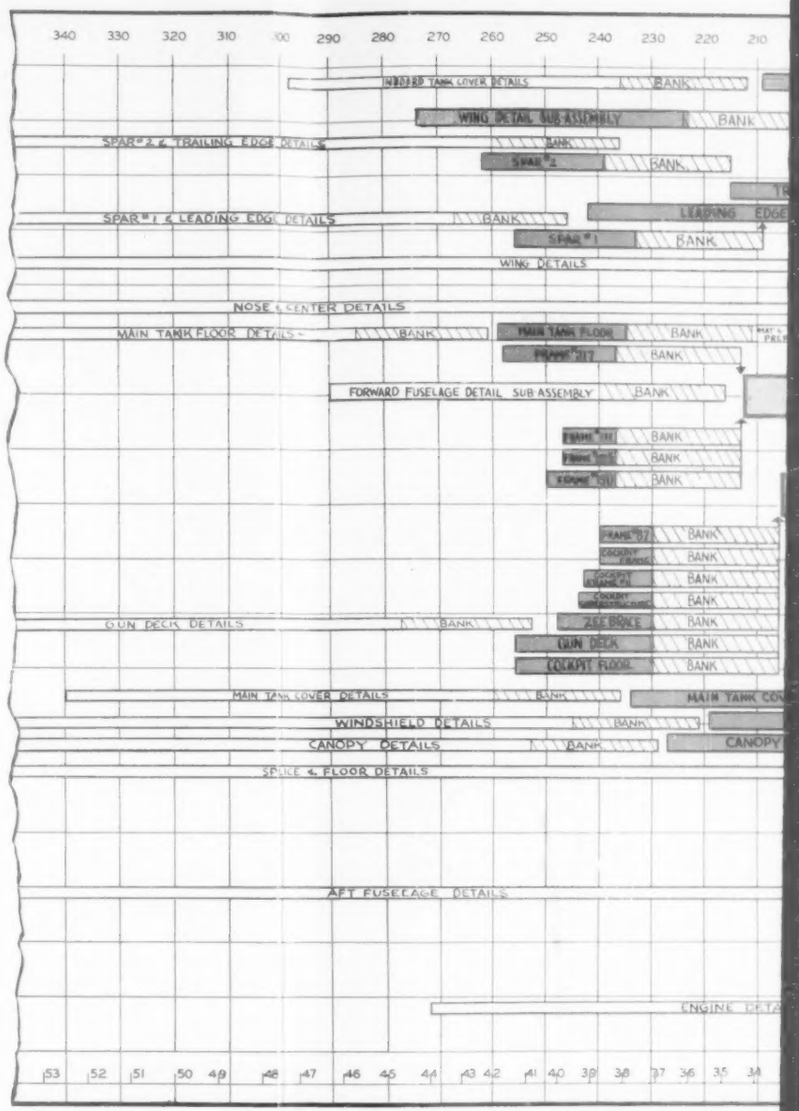
TOOL NUMBER	TOOLING TOOL NAME	QUANTITY
30F11005-1A1A	Main Constr. Jigs	4
30F11005-1A20C	Rotary Jigs	8
30F11005-1A3A	Upper Longeron & Superstructural Jig	*2
30F73601-1A3A	Gun Mt. Fixture	8
30F13965-1A652A	Inverter Access Door Fixture	1
30F81542-1A30A	Radar Unit Lord Mt. to N.B. Checking Temp.	2
30F73568-1A3A	Locates 73568-1 Assy.	1
30F13970-A30B	Spacer Bar G.D. Rail Sta. 66	2
30F11207-2-A80A	Holds Longeron in Position	1
30F12001-½-A590C	Nose Beam Spacer Bar Sta. 48	1
30F12001-1A590A	Locates N.P. for 81560 Plate	1
30F11009-35-A3A	Locates -35 Suppt.	1
30F13750-27-A80A	Drill Temp. for Cockpit Floor Angle & Ducts	1
30F11005-1A590C	Spacer Bar Sta. 71	1
30F13750-28A80A	Drill Temp. for Cockpit Fl. Angle & Ducts	1
30F13550-1-A80A	Drill Temp. Bottom Ducts L/H	1
30F13550-3A80A	Drill Temp. Bottom Ducts R/H	1
30F81530-1-A3A	Locates Clips servo Mt. Sta. 11-40	2
30F11002-3-A3A	Locates 11005-25A,-27A Ammo. Trough Suppts.	1
30F11005-1-A590D	Nose Beam Spacer Cockpit Floor Sta. 121	1
30F11005-1R-A80C	Jack Pad Hole Drill & Locating	1
30F11005-1L-A80C	Jack Pad Hole Drill & Locating	1
30F13788-3-A590A	Drill Temp. Duct & G.D. Angle R/H	1
30F13788-1-A590A	Drill Temp. Duct & G.D. Angle L/H	1
30F13788-6-A590A	Duct Locating Sta. 40	2
30F13750-43-A652A	Check Temp. for 13965 door cutout	1
30F13750-16L-A105C	Drill Temp. for Cockpit Fl. Angle & Ducts	1
30F13750-16L-A80A	Duct Router Bar Top	1
30F13750-16L-A80B	Duct Router Bar Bottom	1
30F13974-1-A590E	Loc. Height from Fl. to Shelf	1
30F13750-43-105A	Drill Temp. for Ducts & Cockpit Floor	1
30F13750-43-A80A	Router Bar Ducts Top R/H	1
30F13750-17-A80B	Router Bar Ducts Bottom R/H	1
30F13727-11-A30A	Locating Door Doubler Sta. 87-99 L/H	1
30F11005-1-A20A	Locates Long. Sta. 150 for Frame Contour	1

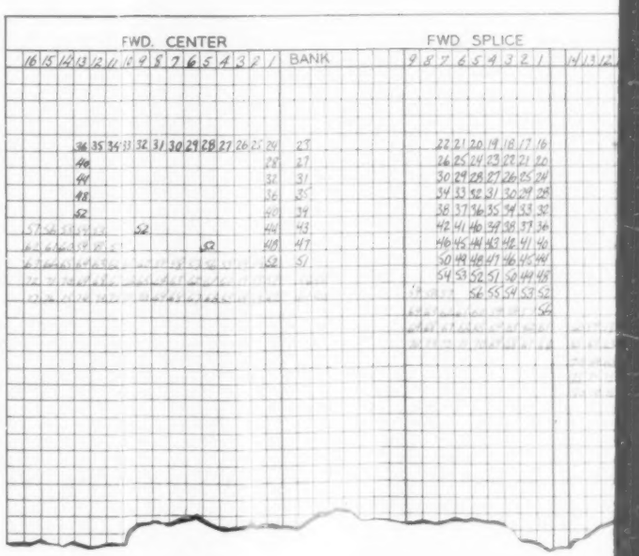
*(With attachments for locating longerons at Sta. 150)

Priority Sequence Chart is the master plan for aircraft assembly at Republic. The sequence chart starts with the release of engineering drawings, then allows for methods analysis and flow time of details. Tool design and manufacture must be coordinated with planned flow time of detail parts and subassemblies, and the manufacture of detail parts then leads into sequencing of flow time for subassemblies made up of the detail parts. Sequencing also includes banks of parts and subassemblies, as indicated in the cross-hatched areas. Subassemblies flow into major assembly areas, shown in blue, where fuselage and wing assemblies reach completion. Final assembly is the last step in manufacture, and sequencing proceeds to zero day, when the plane is towed out the plant door and is turned over to hangar operations for inspection and tests.

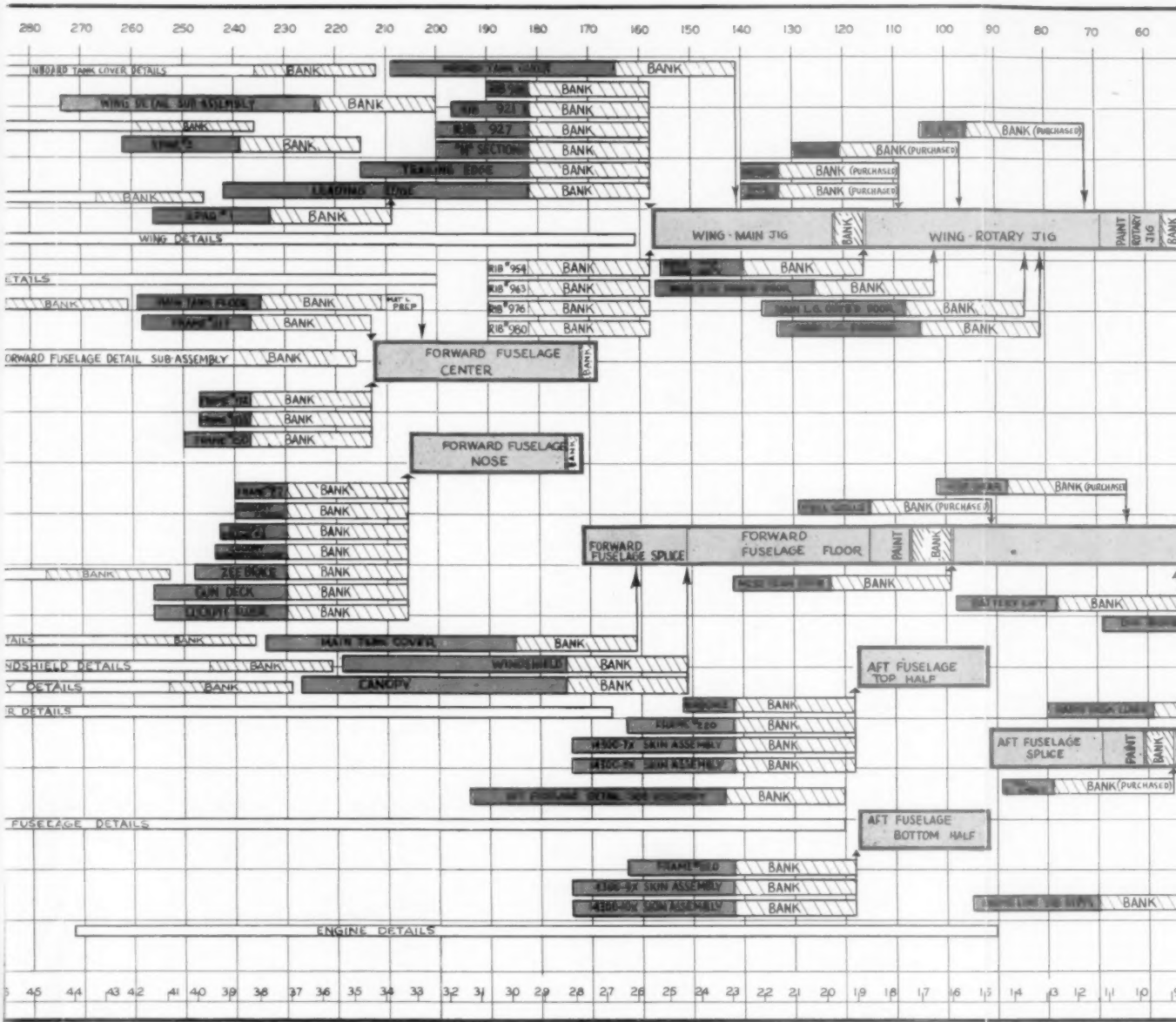
The Cyclograph, a Republic feature, reaches its peak use in scheduling future production rate changes and their effects back along the line in scheduling parts and assembly production. Figures in red refer to assemblies for specific ships which must be advance-scheduled so that the ship can be completed as part of an increased production rate on a specified date. (See text)

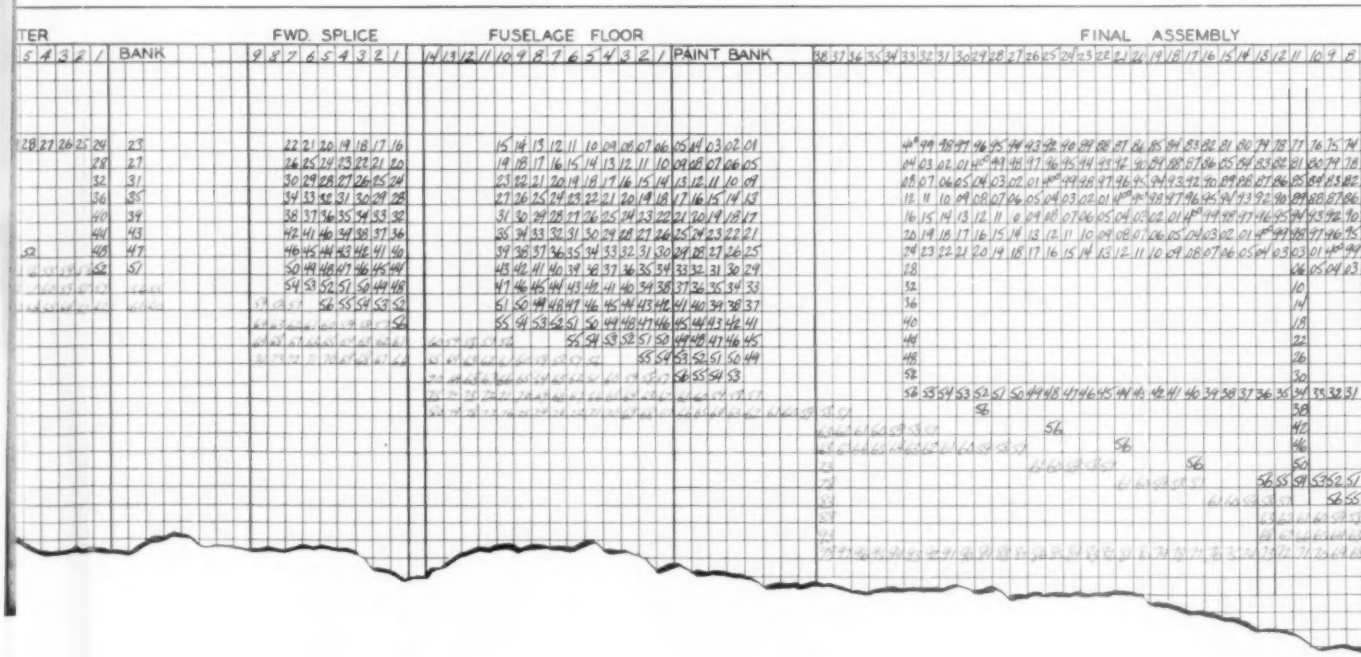

560 550 540 530 520 510 500 490 480 470 460 450 440 430
SPAR #2 & TRAILING EDGE DETAILS
SPAR #1 & LEADING EDGE DETAILS
WING DETAILS
NOSE & CENTER DETAILS
WINDSHIELD DETAILS
CANOPY DETAILS
SPLICE AND FLOOR DETAILS
AFT FUSELAGE DETAILS
80 79 78 77 76 75 74 73 72 71 70 69 68 67 66 65 64 63

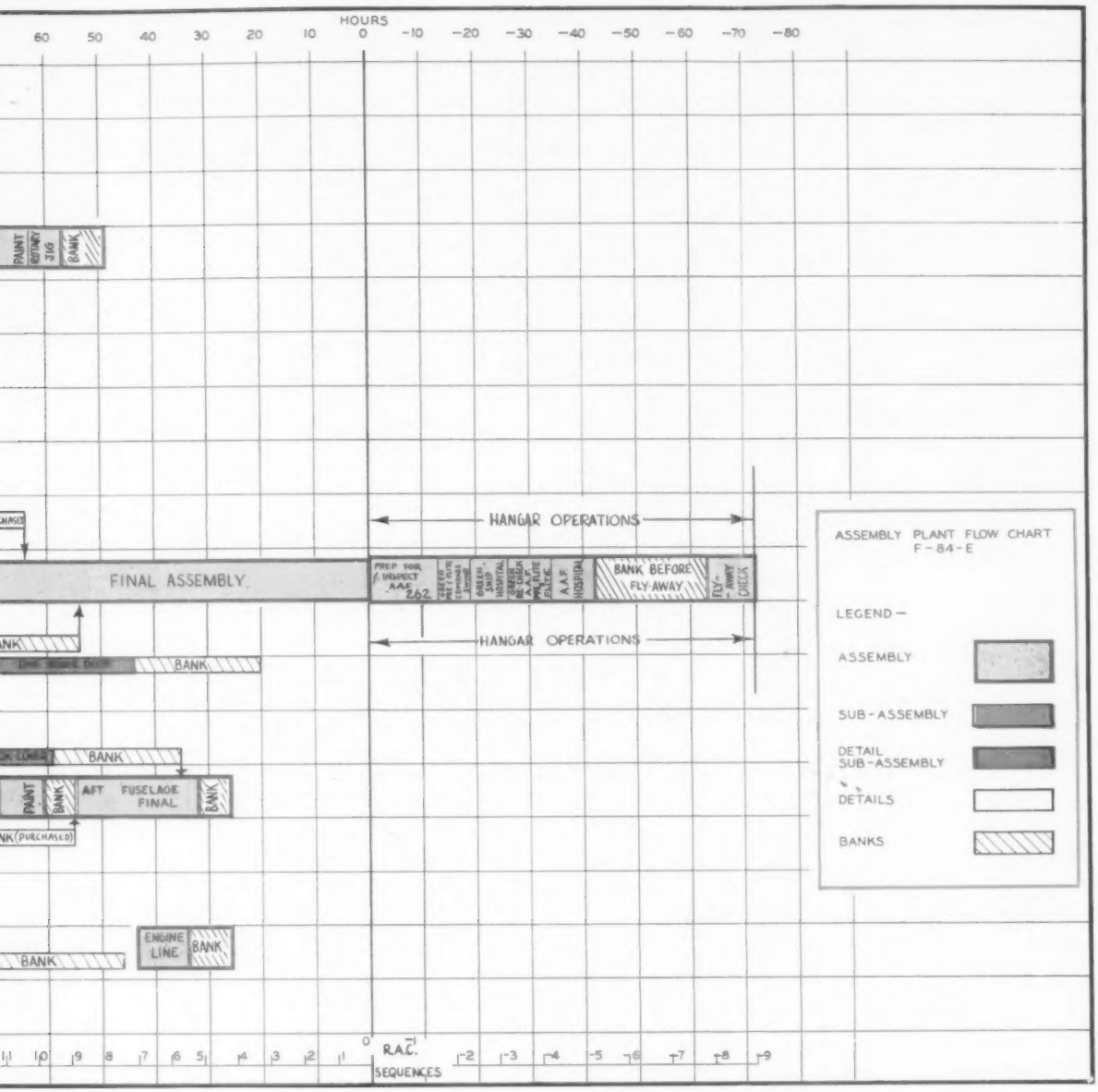




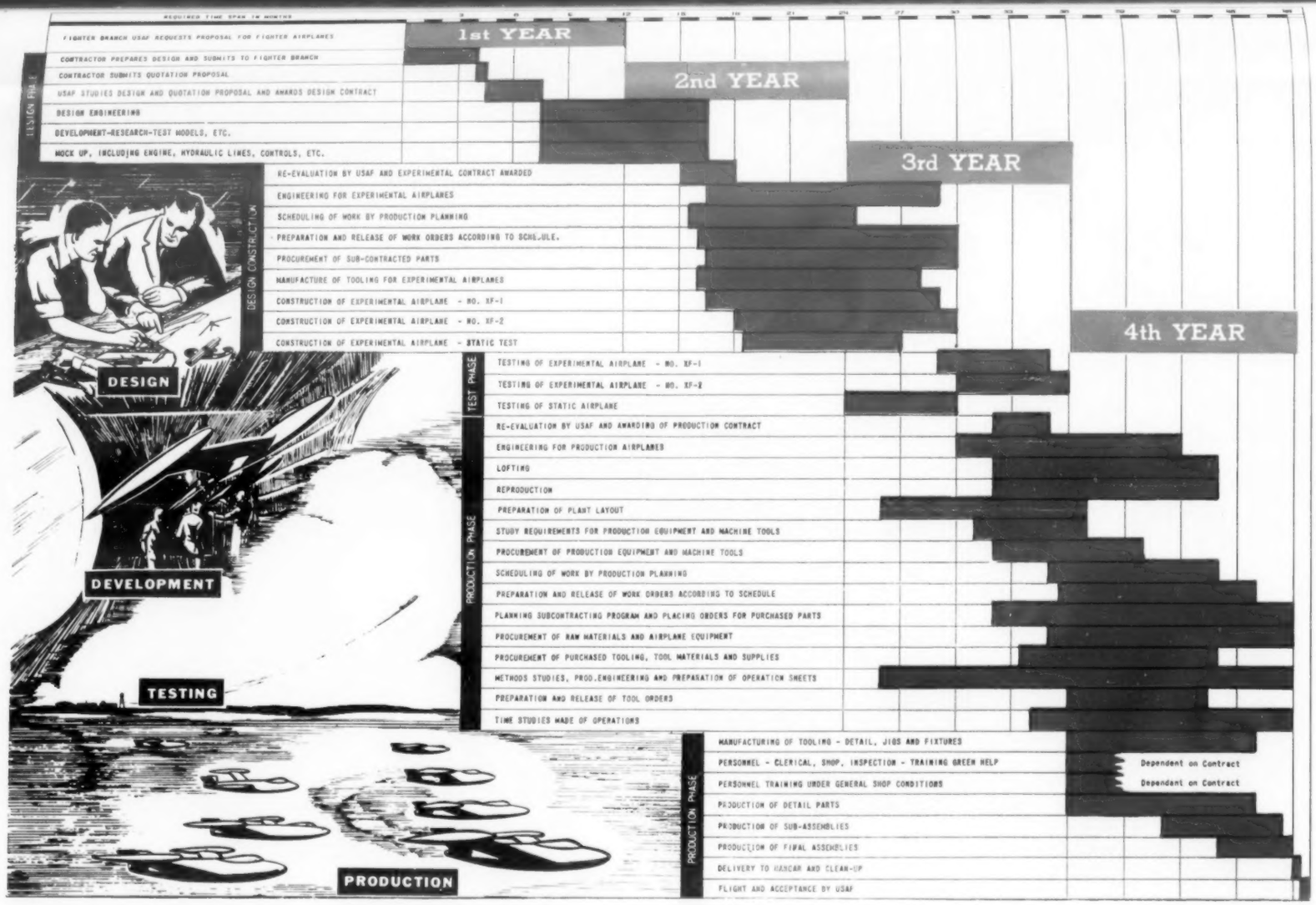
ABOVE: **THE PRIORITY SEQUENCE CHART; REPUBLIC'S MASTER PLAN FOR SCHEDULING PLANE PRODUCTION**


INBOARD TANK COVER DETAILS
WING DETAIL SUB ASSEMBLY
WING DETAILS
LEADING EDGE
TRAILING EDGE
WING - MAIN JIG
WING - ROTARY JIG
PAINT ROTARY JIG
FORWARD FUSELAGE CENTER
FORWARD FUSELAGE NOSE
FORWARD FUSELAGE SPLICE
FORWARD FUSELAGE FLOOR
PAINT
MAIN TANK COVER
CANOPY
AFT FUSELAGE TOP HALF
AFT FUSELAGE SPLICE
AFT FUSELAGE BOTTOM HALF
FUSELAGE DETAILS
ENGINE DETAILS
BANK
BANK (PURCHASED)

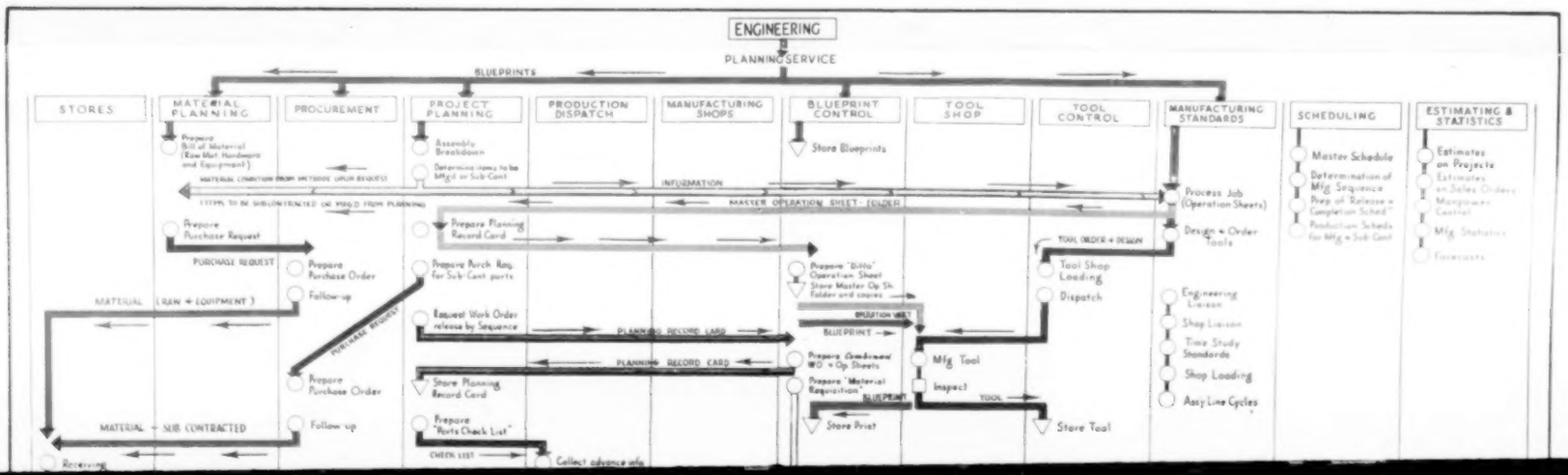

FWD. SPLICE
FUSELAGE FLOOR
PAINT BANK
FINAL ASSEMBLY



LEFT: THE CYCLOGRAPH; WHICH AIDS PLANNING FOR FUTURE CHANGES IN PRODUCTION RATE


REQUIRED TIME SPAN IN MONTHS
1st YEAR
2nd YEAR
3rd YEAR
4th YEAR
DESIGN PHASE
FIGHTER BRANCH USAF REQUESTS PROPOSAL FOR FIGHTER AIRPLANES
CONTRACTOR PREPARES DESIGN AND SUBMITS TO FIGHTER BRANCH
CONTRACTOR SUBMITS QUOTATION PROPOSAL
USAF STUDIES DESIGN AND QUOTATION PROPOSAL AND AWARDS DESIGN CONTRACT
DESIGN ENGINEERING
DEVELOPMENT-RESEARCH-TEST MODELS, ETC.
MOCK UP, INCLUDING ENGINE, HYDRAULIC LINES, CONTROLS, ETC.
DESIGN CONSTRUCTION
RE-EVALUATION BY USAF AND EXPERIMENTAL CONTRACT AWARDED
ENGINEERING FOR EXPERIMENTAL AIRPLANES
SCHEDULING OF WORK BY PRODUCTION PLANNING
PREPARATION AND RELEASE OF WORK ORDERS ACCORDING TO SCHEDULE
PROCUREMENT OF SUB-CONTRACTED PARTS
MANUFACTURE OF TOOLING FOR EXPERIMENTAL AIRPLANES
CONSTRUCTION OF EXPERIMENTAL AIRPLANE - NO. XF-1
CONSTRUCTION OF EXPERIMENTAL AIRPLANE - NO. XF-2
CONSTRUCTION OF EXPERIMENTAL AIRPLANE - STATIC TEST
TEST PHASE
TESTING OF EXPERIMENTAL AIRPLANE - NO. XF-1
TESTING OF EXPERIMENTAL AIRPLANE - NO. XF-2
TESTING OF STATIC AIRPLANE
PRODUCTION PHASE
RE-EVALUATION BY USAF AND AWARDING OF PRODUCTION CONTRACT
ENGINEERING FOR PRODUCTION AIRPLANES
LOFTING
REPRODUCTION
PREPARATION OF PLANT LAYOUT
STUDY REQUIREMENTS FOR PRODUCTION EQUIPMENT AND MACHINE TOOLS
PROCUREMENT OF PRODUCTION EQUIPMENT AND MACHINE TOOLS
SCHEDULING OF WORK BY PRODUCTION PLANNING
PREPARATION AND RELEASE OF WORK ORDERS ACCORDING TO SCHEDULE
PLANNING SUBCONTRACTING PROGRAM AND PLACING ORDERS FOR PURCHASED PARTS
PROCUREMENT OF RAW MATERIALS AND AIRPLANE EQUIPMENT
PROCUREMENT OF PURCHASED TOOLING, TOOL MATERIALS AND SUPPLIES
METHODS STUDIES, PROD.ENGINEERING AND PREPARATION OF OPERATION SHEETS
PREPARATION AND RELEASE OF TOOL ORDERS
TIME STUDIES MADE OF OPERATIONS
PRODUCTION PHASE
MANUFACTURING OF TOOLING - DETAIL, JIGS AND FIXTURES
PERSONNEL - CLERICAL, SHOP, INSPECTION - TRAINING GREEN HELP
Dependant on Contract
PERSONNEL TRAINING UNDER GENERAL SHOP CONDITIONS
Dependant on Contract
PRODUCTION OF DETAIL PARTS
PRODUCTION OF SUB-ASSEMBLIES
PRODUCTION OF FINAL ASSEMBLIES
DELIVERY TO HANGAR AND CLEAN-UP
FLIGHT AND ACCEPTANCE BY USAF
DESIGN
DEVELOPMENT
TESTING
PRODUCTION

Time Span Requirements from the Inception of the Design to the Completion of the First Production Airplane



quencing of parts and details. The number of planes required per 16-hour day determines the elapsed calendar time for each work station, and both determine the complete sequencing of the plane for manufacture of its detail parts. Therefore machine loading is tied, from the floor, directly to the sequencing of each plane, which determines the number of hours each detail subassembly or major assembly must be started. Loading for production of small stampings or machine products is handled on a weekly basis.

Actual loading is graphically presented on charts to establish maximum loading without peaks, where possible. Open time is idle time and is available for other work such as spares and sales orders. Time is figured backward from the finished product to the fabrication of required detail parts.

Republic's Cyclograph is an effective visual aid in establishing production patterns and tracing requirements for assemblies and subassemblies through their various stages of manufacture. As used in the typical sheet illustrated on the gatefold, it aids in establishing schedule-wise increased volume necessary to operate on a production-line basis when a production rate change is planned for the future. In this hypothetical case a change is anticipated of from four to six ships per sixteen hour day. Each plane started is identified by a number which follows it through various assembly stages to delivery. Numbers in red refer to ships which will be produced at the six-a-day rate, and indicate how far back of delivery components must be scheduled to permit shift in production rate on a specific date.

Since a shift in manufacturing

At far left is a graphic presentation of the time span involved in designing and bringing to production a new military plane. Note that about one-half of this time is concerned with various tool engineering phases.

The engineering information flow sheet shown at center capsules the organization and procedure behind the tool engineering activity at Republic. Production and material planning, procurement, tool manufacturing, scheduling and inventory are thus coordinated.

The production flow chart is a plan of Republic's production floor, showing the flow of assemblies and subassemblies into the plane assembly line at center. Plane assembly moves in straight-line flow to completion, then to hangar operations and test flight.

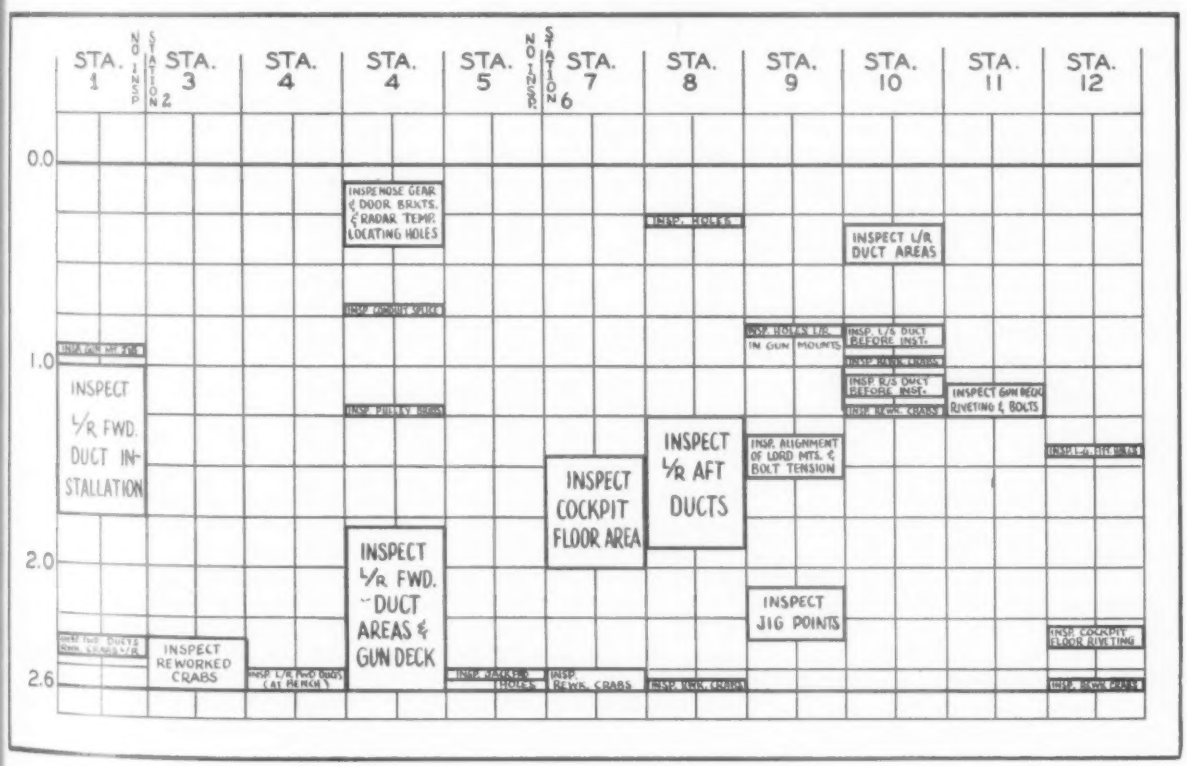
Below is a typical operation sheet, in this case for a series of inspection operations on the F-84E. Each station is planned on a 2.6-hour cycle, with the time factor shown vertically. Each two squares horizontally represents one man. Time and manpower requirements are totalled as shown in box at right.

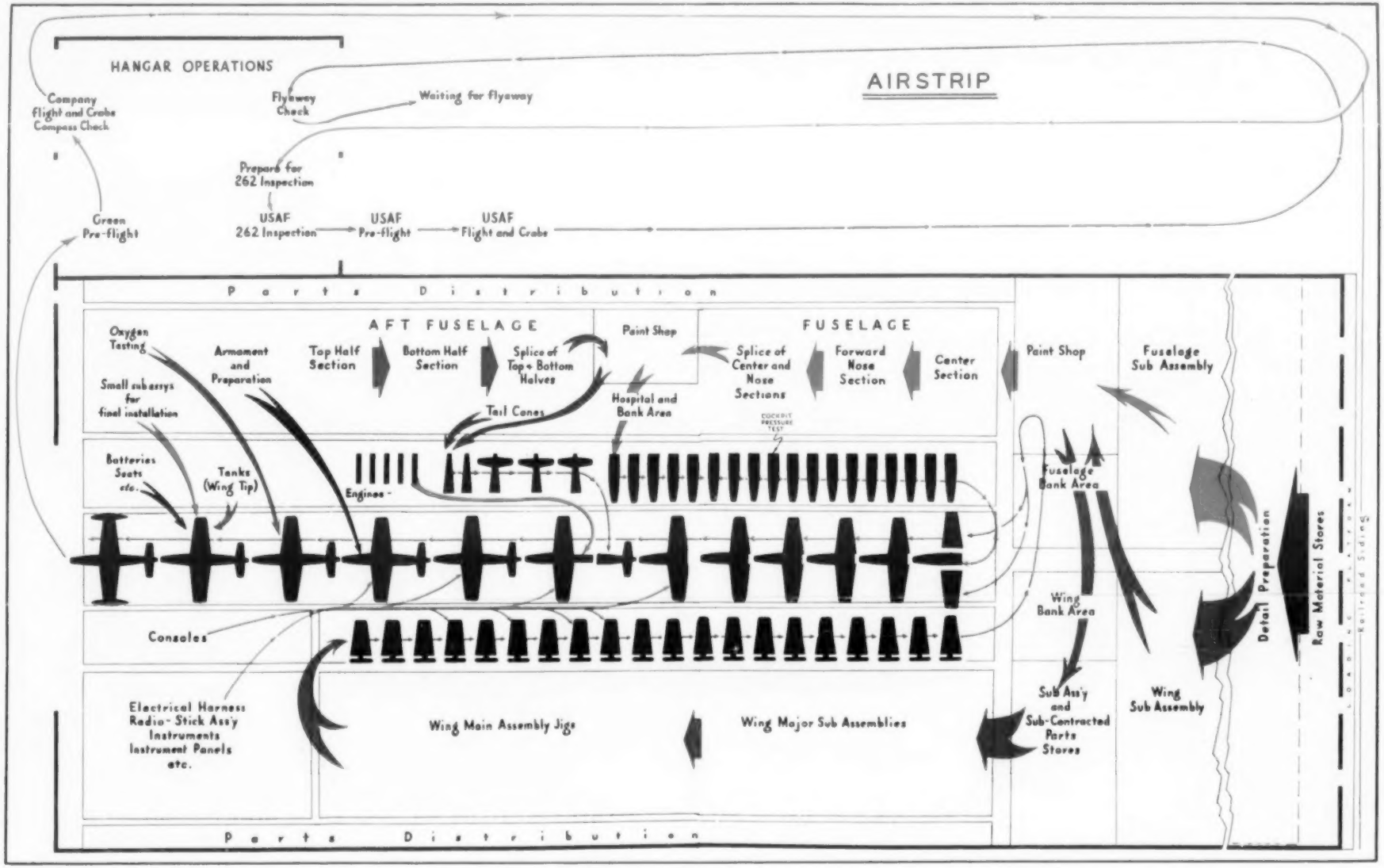
TIME AND MANPOWER ALLOWANCES

F-84E Fuselage Forward Nose

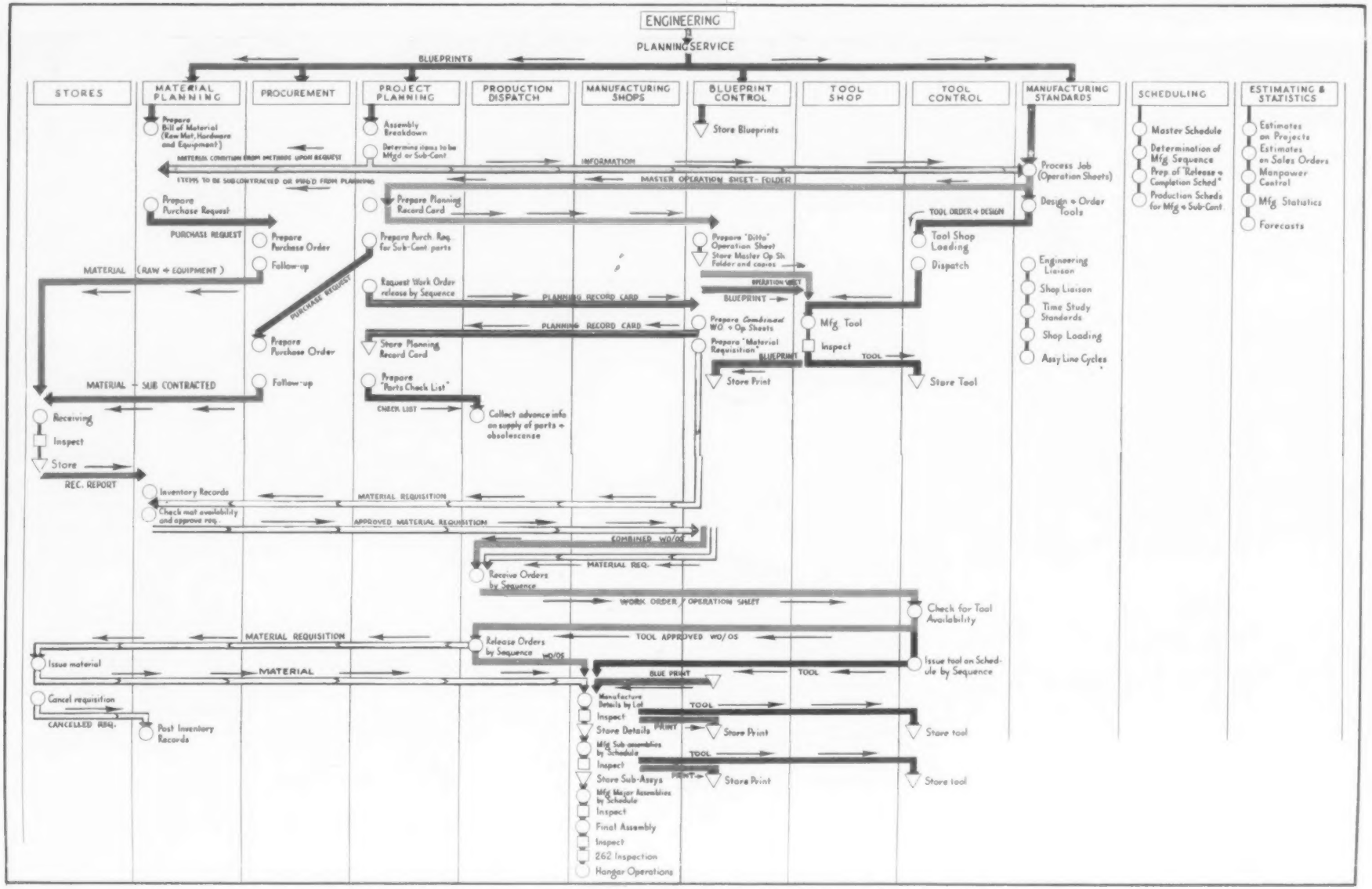
Prod. in 8 hours	3
Number of stations	12
Standard manpower	56
Allowance	5
Lead men	7
Total manpower	68
Station time	2.6
*S/E/H per unit	33.8
Std. M/H per unit	145.6
Total Man-hours per unit	176.8

*2 ships in Sta. 12





Production Flow of Assembly Operations Through Republic's Farmingdale, N.Y., Plant



Flow Chart of Engineering Information Through Republic's Production Division and General Manufacturing Processes

Republic's two assembly lines on the F-84E are shown in the foreground at left. Fuselage assemblies can be seen in background.

rate (in this hypothetical case from four to six per day) means a change in permissible time per station (in this case what was a four-hour station will become a 2.66-hour station), the situation is comparable to a car traveling at 6 mph, and following a car traveling at 4 mph. Thus lead time is required ahead of components scheduled at the six-a-day rate, and this is shown on the Cyclograph. Each blank space represents one day in the sequencing, and production is scheduled, as can be seen, so that at final assembly the six-a-day flow is following the four-a-day flow out the door.

Quality Control

Aircraft quality control is of necessity more complex than is the case with most other assembly operations. Quality control at Republic is headed by a quality control manager with rank on a level with the factory manager and production department manager, and the activity is broken down into inspection and control departments.

A breakdown of inspection operations would include the following departments: receiving and shipping, quality control laboratory, magnetic and florescent tests, gage control, tools, detail parts, machined parts, assembly, flight and modification departments, outside procurement, sub-contractors and the experimental shop. Control and analysis of materials and processes are exercised by the quality control laboratory, material review section, quality control analysis department, and, of course, the quality control administrative staff.

Receiving inspection is one of the most important quality control sections, since it deals with the tremendous quantity of parts, assemblies, raw material, sub-contract items, government furnished equipment, controls and electronic devices which go into a jet plane, and which must be purchased on the outside.

For administrative purposes this list of materials is divided into three classifications. Policy items include those parts which, if they failed, would directly affect the safety of the plane and its personnel; and which cannot be adequately inspected except at the source, or point of manufacture. They are Air Force-inspected at the source, and are accepted by Republic to predetermined standards as required.

Structural raw material, structural purchase, parts, fabricated parts, etc. must pass a quality standard check on receipt or at source.

Inspection in the parts plant and machine shop is maintained on a progressive basis, with inspections set up at various stages in production to reduce final assembly rejects. In the parts plant, the first piece from presses, brakes or drop hammers is inspected for conformance to specifications. Spot welding is periodically checked by pulling shear test specimens. Subassemblies are checked progressively in the jig, and final inspection is made of the full assembly.

Parts Inspection

Detail parts inspection in the machine shop is similar, with periodic checks at each machine. Next, all detail parts are inspected at the completion of the run. Final step is checking of the complete assembly, after which the assembly is stamped and passed on for further installation.

Assembly inspection includes separate inspection of fuselage sections, wings and control surfaces, and the installation of the power plant system, hydraulic system and pneumatic system. Procedure includes inspection of the details in the assembly, the finished assembly and its installation. A final inspection is carried out on the completed plane before it leaves the assembly floor.

To direct disposition of material, parts, assemblies and equipment which are found to be defective or which deviate from specifications, Material Review Sections operate throughout the plant. Each section is responsible for an assigned area, and is supervised by a Material Review Board composed of a Republic Material Review inspector, a Republic Material Review engineer and an Air Force inspector. The Section analyzes the defect—either in a bonded Material Review Crib or on the spot and makes recommendations.

Directory of A.S.T.E. Chapter Chairmen

...X, C-47
...rd Monday*
...O. Hunt, 124 N. Harmony St., ...dina, O.

...QUERQUE, C-93
...st Friday*
...ome F. Durrie
...0 48th Loop
...dia Base, Albuquerque, N.M.

...NTA, C-61
...rd Monday*
...Clarence E. Redfern, Auto Soler Co., 267 Marietta St., N.W., Atlanta 3, Ga.

...TIMORE, C-13
...st Wednesday*
...John W. Schukraft, 1213 E. Belvidere, Baltimore 12, Md.

...GHAMTON, C-35
...cond Wednesday*
...Donald L. Ellis, 97 Front St., ...ntal, N.Y.

...TON, C-33
...cond Thursday*
...Prescott A. Smith, Mass. Inst. of ...ch., 77 Massachusetts, Cambridge 39, Mass.

...FFALO-NIAGARA FRONTIER, C-10
...cond Wednesday*
...Wilbur J. Reich, 1036 Town Line Rd., Lancaster, N.Y.

...AR RAPIDS, C-71
...Third Wednesday*
...W. D. Popek, 84 Wilson Ave., S.W. Cedar Rapids, Ia.

...NTRAL PENNSYLVANIA, C-22
...rst Monday*
...David A. Schrom, 554 Pacific ...ve., York, Pa.

...ICAGO, C-5
...cond Tuesday*
...Harold D. Long, 1901 S. Rockwell, Chicago 8, Ill.

...CINNATI, C-21
...cond Tuesday*
...Edgar L. Routzong, 6131 Robison Rd., Cincinnati 13, O.

...VELAND, C-3
...cond Friday*
...R. C. Southwell, 2025 Belvoir Blvd., Cleveland 12, O.

...LUMBUS, C-36
...cond Wednesday*
...Milner D. Sherman, 2745 Camden Rd., Columbus 12, O.

...YTON, C-18
...cond Monday*
...Lawrence R. McAfee, Peninsular Steel Co., 401 Kiser St., Dayton 4, O.

...CATUR, C-58
...st Tuesday*
...James H. Clark, 1090 W. Tuttle, Decatur, Ill.

...NVER, C-77
...First Wednesday*
...Warren L. Foss, 930 S. Elizabeth, Denver 9, Colo.

...S MOINES, C-80
...Third Wednesday*
...Clyde Allen, 836 Douglas, Des Moines 13, Ia.

...TROIT, C-1
...cond Thursday*
...John D. Anderson, 13860 Fairmount Dr., Detroit 5, Mich.

...MIRA, C-24
...First Monday*
...Henry G. Lemaire, RD 1, River Rd., Elmira, N.Y.

...IE, C-62
...First Tuesday*
...Robert J. Wilson, Jr., 10 Henry St., Warren, Pa.

...ANSVILLE, C-73
...cond Monday*
...Charles H. Thuman, Seeger Refrigerator Co., 225 W. Morgan Ave., Evansville 7, Ind.

...RFIELD COUNTY, C-6
...First Wednesday*
...Douglas F. Linsley, 250 S. Compo Rd., Westport, Conn.

FOND DU LAC, C-45
Second Friday*
Charles Billberg, Wisc. Axle Div., 567 High St., Oshkosh, Wis.

FORT WAYNE, C-56
Second Wednesday*
Ralph J. Didier, 2501 Wayne Trace, Ft. Wayne 4, Ind.

FOX RIVER VALLEY, C-72
First Tuesday*
George Bodi, 519 Edwards St., Aurora, Ill.

GOLDEN GATE, C-28
Third Wednesday*
G. B. Berlien, Ind. Steel Treating, 600 Fallon St., Oakland, Calif.

GRAND RIVER VALLEY, C-81
First Friday*
Harry J. Sehl, Sehl Eng'g. Co., Kitchener, Ont., Can.

GRANITE STATE, C-86
Second Tuesday*
Charles M. Nystedt, 24 Meadow Rd., Durham, N.H.

HAMILTON, C-42
Second Friday*
J. E. R. Yorick, 105 Sterling St., Hamilton, Ont., Can.

HARTFORD, C-7
First Monday*
R. M. Toppin, Jacobs Mfg. Co., W. Hartford, Conn.

HOUSTON, C-29
Second Tuesday*
Robert E. Schuller, 7024 Avenue N., Houston 11, Texas

INDIANAPOLIS, C-37
First Thursday*
Ernest W. Hilkenbach, 2433 N. Illinois St., Indianapolis 8, Ind.

JACKSON, C-87
Last Tuesday*
Frank E. Gokay, 334 Hibbard, Jackson, Mich.

KANSAS CITY, C-57
First Wednesday*
Ivan J. Nelson, 2239 Garfield Ave., Kansas City 2, Kans.

LANCASTER, GREATER, C-89
Joseph H. Resser, Sr.
Neffsville, Pa.

LEHIGH VALLEY, C-83
Third Friday*
James R. Fairhurst, 91 Harte, Phillipsburg, N.J.

LITTLE RHODY, C-53
First Thursday*
C. B. George, 276 Niantic Ave., Providence 7, R.I.

LONDON-ST. THOMAS and DISTRICT, C-91
Albert H. Ward, 560 South St. Apt 3, London, Ont., Can.

LONG BEACH, C-84
Second Wednesday*
William B. MacKay, 260½ Glendora Ave., Long Beach 3, Calif.

LONG ISLAND, C-88
Henry Maehl, Fairchild Engine Div., Fairchild Engine & Airplane Corp., Farmingdale, L.I., N.Y.

LOS ALAMOS, C-92
First Thursday after First Wednesday*
Joseph A. Parks, 2218-B 37th St., Los Alamos, N.M.

LOS ANGELES, C-27
Second Thursday*
G. J. Walkey, 1524 Pepper St., Burbank, Calif.

LOUISVILLE, C-54
Second Wednesday*
W. D. Wuest, 916 Greenleaf Rd., Louisville 13, Ky.

MADISON, C-75
Second Tuesday*
A. G. Hoffer, Gisholt Mach. Co., 1245 E. Washington, Madison 10, Wis.

MID-HUDSON, C-74
Second Tuesday*
William W. Schug, 8 Janis St., R.D. 2, Hudson, N.Y.

MILWAUKEE, C-4
Second Thursday*
Walter O. Behrend, 2817 N. 48th St., Milwaukee 10, Wis.

MOHAWK VALLEY, C-78
Fourth Tuesday
Arnold K. Schroeder, 2810 Leibel Pl., Utica 3, N.Y.

MONTREAL, C-50
Second Thursday*
J. P. Cloutier, 5035 Ontario E., Montreal, Que., Can.

MUNCIE, C-70
First Tuesday*
H. L. Mendenhall, N. Tillotson Ave., RFD 7, Muncie, Ind.

NASHVILLE, C-43
Third Tuesday*
A. Scobey Rogers, Jr., 2808 Westwood Ave., Nashville, Tenn.

NEW HAVEN, C-41
Second Thursday*
David J. Mathewson, Mathewson Tool Co., 28 Richards St., West Haven, Conn.

NEW YORK, GREATER, C-34
First Monday*
Edward Galvin 22 Forest Ave., Hastings-on-Hudson, N. Y.

NIAGARA DISTRICT, C-65
First Thursday*
F. W. Dunn, 366 Church Rd., RR 5, St. Catharines, Ont., Can.

NORTH TEXAS, C-51
Last Friday*
John K. Turvene, 3003 Aster St., Dallas 11, Texas

NORTHERN NEW JERSEY, C-14
Second Tuesday*
James Allan, 285 Munroe Ave., Wyckoff, N.J.

PEORIA, C-31
First Tuesday*
Duane H. Brighton, 125 S. Eleanor, Peoria, Ill.

PHILADELPHIA, C-15
Third Thursday*
Willard J. Griffith, Rittenhouse Rd., Fairview Village, Pa.

PIEDMONT, C-82
Second Monday*
A. F. Moosbrugger, 14 F College Village, Winston Salem 5, N.C.

PITTSBURGH, C-8
First Friday*
W. J. Bickmore, 3942 Forbes St., Pittsburgh, Pa.

PONTIAC, C-69
Third Thursday*
John M. Fritcher, 933 Cameron Ave., Pontiac 17, Mich.

PORTLAND (ME.), C-46
Second Friday*
Carl A. Snow, 10 Hastings, Portland 5, Me.

PORTLAND (ORE.), C-63
Third Thursday*
Walter L. Brenneke, 2434 N. E. 21st Ave., Portland 12, Ore.

POTOMAC, C-48
1st Thurs. after 1st Mon.*
B. E. Thomasson, 4900 13th St., N., Arlington, Va.

RACINE, C-2
First Monday*
George S. Strombeck, Racine School of Voc. Adult Educ., 800 Center St., Racine, Wis.

RICHMOND, C-66
Second Tuesday*
Dezell Gibbs, Perfect Circle Corp., 522 S. Washington, Hagerstown, Ind.

ROCHESTER, C-16
First Monday*
James O. Horne, James O. Horne Co., 212 Powers Bldg., Rochester 14, N.Y.

ROCKFORD, C-12
First Wednesday*
George P. Torrence, Jr., Ingersoll Milling Mach. Co., Rockford, Ill.

SAGINAW VALLEY, C-68
Third Thursday*
Russell M. Ayers, 3410 Gratiot, Flint 3, Mich.

ST. LOUIS, C-17
First Thursday*
L. W. Greenblatt, Jr., 7814 Maplewood Ind. Ct., St. Louis 17, Mo.

SALT LAKE CITY, C-85
1st Fri. after 1st Wed.*
Leslie C. Seager, 1194 Crystal Ave., Salt Lake City 6, Utah

SAN DIEGO, C-44
Second Tuesday*
A. P. Manino, 4816 Federal Blvd., San Diego 2, Calif.

SCHENECTADY, C-20
Second Thursday*
Benjamin E. Storrs, 37 Wallace St., Scotia 2, N.Y.

SEATTLE, C-39
Fourth Tuesday*
Francis L. Coenen, 7756 Mission Dr., Seattle 88, Wash.

SOUTH BEND, C-30
Second Tuesday*
H. A. Goltz, 1206 Portage Ave., South Bend, Ind.

SPRINGFIELD (ILL.), C-64
First Tuesday*
Roger W. Wallace, 1930 N. 6th St., Springfield, Ill.

SPRINGFIELD (OHIO), C-76
Fourth Thursday*
Eldon M. Neff, 1515 Maryland Ave., Springfield 20, O.

SPRINGFIELD (MASS.), C-32
Second Monday*
Jason G. Doubleday, North Rd., Hampden, Mass.

SYRACUSE, C-19
Second Tuesday*
Carl J. Hoffman, 21 Reed Parkway, Marcellus, N.Y.

TOLEDO, C-9
Second Wednesday*
Dale H. Burke, 4238 N. Lockwood Ave., Toledo 12, O.

TORONTO, C-26
First Wednesday*
Douglas R. Cooper, Can. Fairbanks Morse Co., 137 Harbour St., Toronto, Ont., Can.

TRI-CITIES, C-23
Second Wednesday*
Joseph Zelnio, 421 11th St., Moline, Ill.

TULSA, C-90
Second Thursday*
Louis H. Trainor, 1248 S. Pittsburg, Tulsa 12, Okla.

TWIN CITIES, C-11
First Wednesday*
Peter S. Tobias, 4451 5th St., N.E., Minneapolis, Minn.

TWIN STATES, C-40
Second Wednesday*
Floyd J. McArthur, 2 Circular St., Springfield, Vt.

WATERLOO AREA, C-79
Last Wednesday*
James A. McCollum, 2015 Highland Dr., Ann Arbor, Mich.

WESTERN MICHIGAN, C-38
Second Monday*
Claude C. Hanish, 420 Elliott S.E., Grand Rapids 7, Mich.

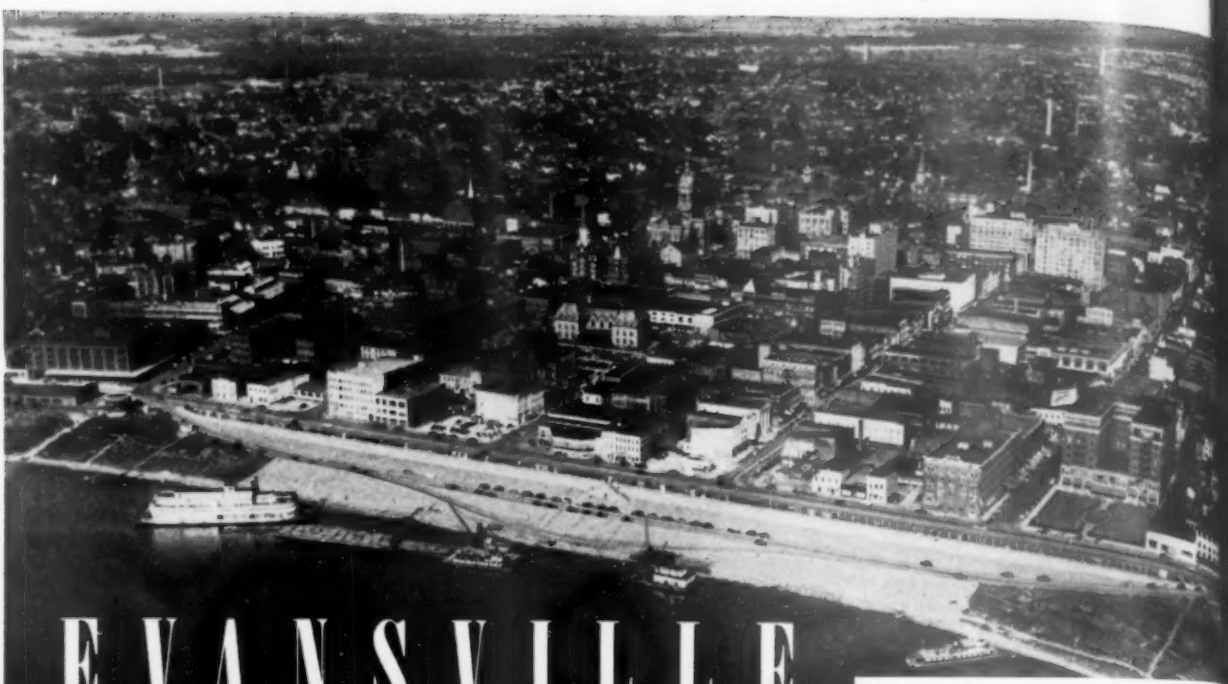
WICHITA, C-52
Second Wednesday*
Hazen I. Dool, 847 Marcilene, Wichita 17, Kans.

WILLIAMSPORT, C-49
Second Monday*
Richard S. Huskin, 808 Lincoln Ave., Williamsport 31, Pa.

WINDSOR, C-55
Second Monday*
H. J. A. Chambers, Std. Mach. & Tool Co., 870 Ottawa St., Windsor, Ont., Can.

WORCESTER, C-25
First Tuesday*
Ralph A. Baker, Whitin Machine Wks., Whitinsville, Mass.

*Meeting Night



EVANSVILLE

Invites 2000

Southern Indiana's Leading Industrial City Hosts Defense Tooling Program, Semi-Annual Board Meeting

DOES YOUR membership card read: Indianapolis, St. Louis, Dayton, Cincinnati, Peoria, Nashville, Louisville, Decatur, Springfield, Ill., Richmond, Muncie, or Evansville chapter?

Then you're among the 2000 privileged to participate in an ASTE semi-annual meeting this year. An invitation is on the way to you for a two-day meeting of South Central members at Hotel Vendome, Evansville, Ind., October 19 and 20.

Traveling Members Welcome

And if you're affiliated with groups as far east as the Atlanta or Piedmont chapters, or just traveling in the Evansville area, you'll be warmly welcomed by Charles H. Thuman, Evansville chapter chairman, and his committee.

Mr. Thuman, assisted by area chapter chairmen and members of his own chapter, has arranged an attractive schedule in conjunction with the National Program Committee, whose chairman is Gardner Young of Pittsburgh.

Bridges Convention Interim

The only nationally sponsored Society meeting bridging the interval between annual conventions, it comes when engineering knowledge is urgently needed in defense work. Industry recognizes this conference by contributing to the technical program. So does the Government. The Army has assigned an Ordnance general to talk on tooling for materials of war. And a university is sending one of its administrative officers to tell you how to put yourself and your ideas across to the boss.

Besides these and other business activities, there are enough social events on the program to make it a pleasant, family weekend excursion at a season when Nature is in one of her happier moods.

Only 75 miles from the U. S. center of population and the leading industrial town within 100 miles, Evansville is a logical rendezvous for members in this area.

Population Upped One-Third

Even the U. S. Census Bureau rubbed its eyes when it totted up the latest nose count and found Evansville outstripping all other Indiana cities in rate of growth. In ten years its population has jumped a third, to 128,636 in the metropolitan area.

Curving around a sharp U-bend in the Ohio River, Evansville has transportation facilities that make it a hub junction where raw materials and finished products meet.

TWO OF the older and larger industries, in Evansville and in their respective fields, will escort the visiting ASTE'ers through their plants. If you're interested in the construction of heavy equipment, you'll sign up for the Bucyrus-Erie Co. tour Friday morning.

From forging to freight car, you can see powerful bulldozers, motor shovels, derricks, excavators, bullgraders, dragline, and similar equipment being built

A. S. T. E. NEWS

Doris B. Pratt, Editor

Large testing instruments are operated on research projects in the new Engineering and Science building of Evansville College, southern Indiana's only major institution of higher learning.

ar shipment around the world as tools f war and implements of peace.

In the forging shop, you'll admire he dexterity of workers who can smack steam hammer down on a hot forging, ith a 25-ton force, or ease it gently ough to just graze an eggshell. From here you'll go through the tool room, aintenance, winch, and cab depart-ents, plate and weld, machine and erecting shops.

Evolved From Buggy Building

Over a half-century the manufactur-ng firm that is now Servel, Inc. has progressed from buggies to mechanical refrigerating and cooling equipment, compressors for commercial refrigera-tion, and copper ball water heaters of unconventional design. There you'll see mass precision in the production of these aids to comfortable living.

Traveling along a mile of conveyor line in the largest gas welding depart-ment under one roof, basic parts are joined into a continuous leak-proof refrigeration unit. Tests are so exact-ing that they will reveal a leak requir-ing 10,000 years to fill a quart bottle.

Also on the itinerary are the largest industrial steam generating plant in the area, the heat treat department, toolroom, automatics, galvanizing, tube bending and reducing, sheet metal and press operations, porcelain enameling; and production, testing and assembly operations for other company products.

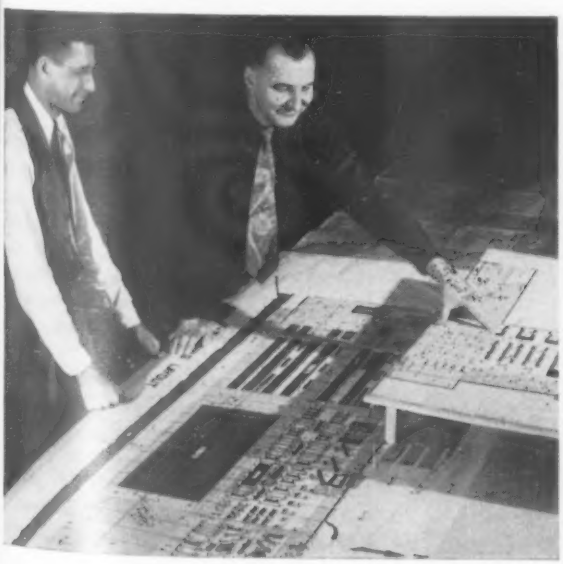
To Do Wing Presswork

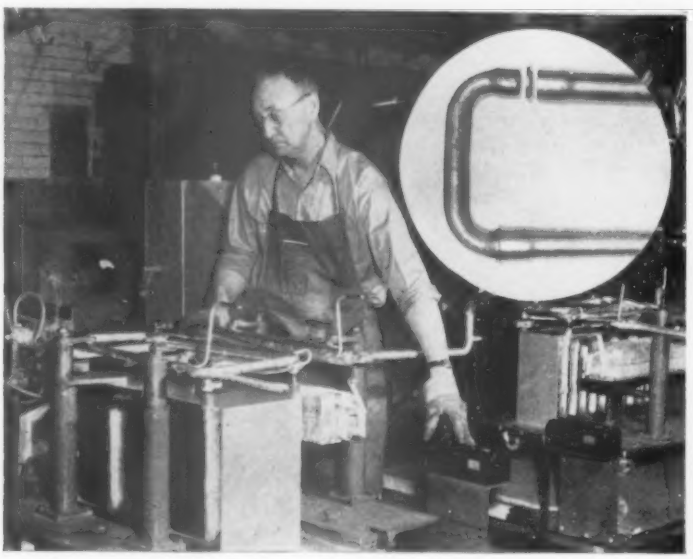
For its dual role in the "guns and butter" program, Servel is gearing up to turn out 105 mm. steel cartridge cases, and wings for F-84 Thunderjet fighters. Even before the roof went on, giant presses were being installed in a plant nearing completion for the wing building activity.

TECHNICAL SESSIONS are keyed to members' requests for defense tooling subjects. While discussing "Developments in Carbide Tools and Dies," J. S. Gillespie, manager of production sales for the Carboloy Department of General Electric Co., Detroit, Mich., will explore some of the latest findings in the trepanning of deep holes. This talk is scheduled for 1:30 Friday afternoon. National Program Chairman Gardner Young will conduct the session.

Tools and methods that have helped Ordnance lick tough problems in making new weapons will be revealed by

Upper right: Hotel Vendome will hum with activity during ASTE week-end meeting at Evansville. Below, left: Using a scale model, two engineers plan the interior layout of a new plant Servel, Inc. is building to make wings for F-84 Thunderjet fighter planes. Right: "Ferrofusion" welding of refrigeration unit evaporators will be demonstrated along route of the ASTE tour of Servel. Inset shows parts of the unit to be joined by the high frequency heating method.





General Merle H. Davis, chief of the Ammunition Branch of the Industrial Division, Washington, D. C.

Roger F. Waindle, second vice-president of the Society and a member of the Army Ordnance Association, will introduce General Davis to his audience.

Panel Studies Professional Status

In an open discussion at 3:30 Friday afternoon, a six-man panel will weigh the "Tool Engineer's Professional Status."

Members of this group are: Howard C. McMillen plant manager, Philco Corp., Bedford, Ind.; Gordon Swardenski, general superintendent, planning department, Caterpillar Tractor Co., Peoria, Ill.; William L. Dolle, president, Lodge & Shipley Co., Cincinnati, Ohio; Willis G. Ehrhardt, partner, Ehrhardt Tool & Machine Co., St. Louis, Mo.; Halsey F. Owen, associate professor, industrial engineering, Purdue University, Lafayette, Ind., and George C. Tillotson, sales engineer, Delco Products Div., General Motors Corp., Dayton, Ohio.

Roger W. Wallace, technical superintendent, Sangamo Electric Co., Springfield, Ill., will moderate the forum.

President Jacob J. Demuth of St. Louis will lead a Saturday morning round table to iron out Society problems at member, chapter, and national levels. National officers and committee chairmen will get together with executives from the area chapters, answer questions, make suggestions, and acquaint the visitors and host group with the Society's plans and projects.

Demuth to Install Directors

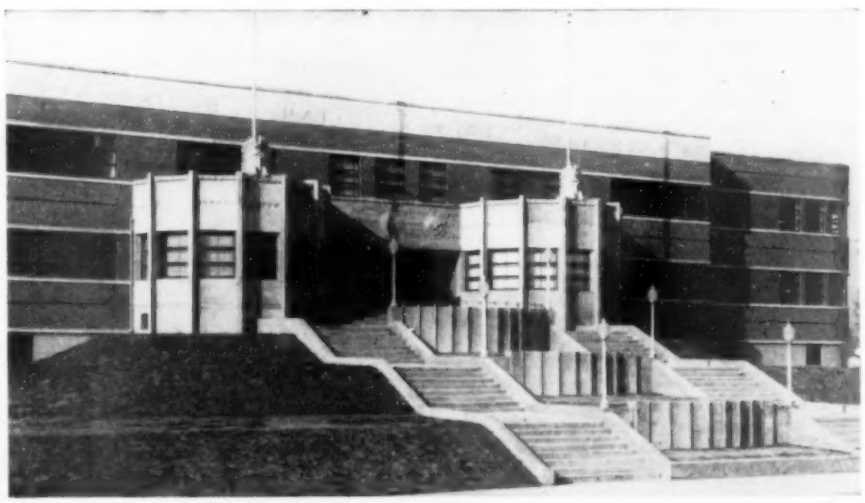
At the opening of the semi-annual meeting of the board of directors, Friday, President Demuth will swear in Directors-Elect Harold E. Collins, chief production engineer, Hughes Tool Co., Houston, Texas; William B. McClellan, sales engineer, Gairing Tool Co., Detroit, Mich.; George A. Goodwin, chief process engineer, Master Electric Co., Dayton, Ohio, and H. B. Osborn, Jr., technical director, Tocco Div., Ohio Crankshaft Co., Cleveland, Ohio.

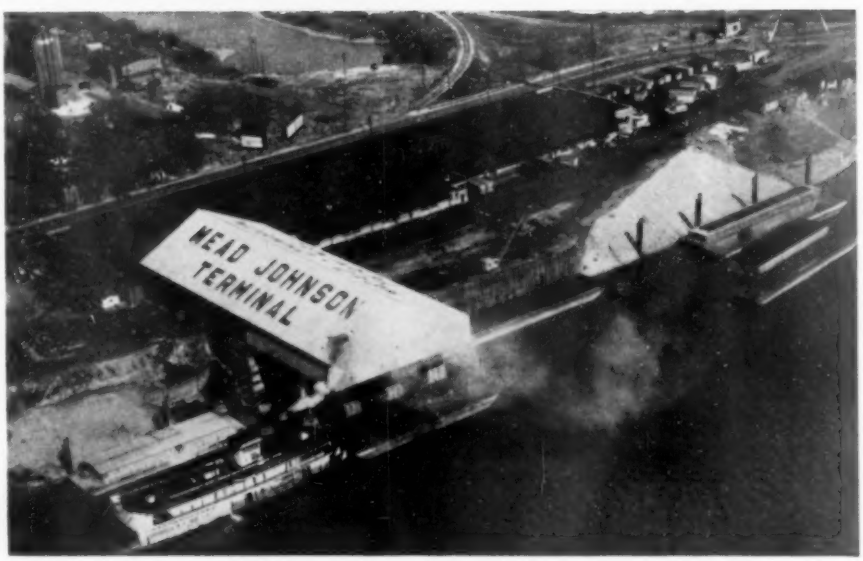
When his committee convenes Saturday, Andrew B. Clark of Cleveland, national membership chairman, will brief them on the next stage of the "20th year, 20,000 members" campaign.

To accommodate early arrivals, a desk will be set up Thursday evening in the Vendome lobby for advance registration. It will open again at 8:30 Friday morning. Registration fee is $1.00 as usual.

Machining of heavy parts for earthmoving equipment will be viewed by tool engineers visiting Bucyrus-Erie Co.

Upper: One of Evansville's modern public buildings, the National Guard Armory does double duty as a recreation center. Lower: More than 150,000 tons of freight per year are transferred from one form of transportation to another in the Mead Johnson river-rail-truck terminal.





YOU MAY meet your ASTE neighbors from next door, next chapter or next state when you sit down at the banquet Friday evening.

Speaking on "Tools, Tactics and Techniques," Dr. Frank C. Hockema, vice-president and executive dean of Purdue University, Lafayette, Ind., will give tool engineers down-to-earth, practical pointers on how to sell management on "spending to save" with efficient tooling.

Barber Shop Quartets to Sing

For entertainment you'll hear a 40-voice chorus of the Evansville chapter of the Society for the Preservation and Encouragment of Barber Shop Quartet Singing in America. They'll sing under the direction of Jerry Beeler, a former national president and founder of the Evansville parent chapter of the organization.

Recently returned from a five-weeks' tour of service centers in Korea with a former national champion quartet from Chicago, Mr. Beeler is general manager of the Mead Johnson Terminal Corp. and president of the Evansville Board of Aviation.

Left: A tense moment at Engle Studio in Newburgh, Ind., as the kiln is opened and the glazed artware is examined after its ordeal by fire. A trip to this ceramic plant is in store for ladies who come to the South Central meeting.

Right: Only a few miles from Evansville, in Audubon State Park near Henderson, Ky., this museum is colorful with the plumage of North American birds as painted by John James Audubon.

In addition to the group concert, there will be specialty numbers by the Dixieliners and the Songfellows quartets.

YES, LADIES may attend the dinner party. Besides, there's a special program to occupy them during the two-day meeting. First thing Friday morning they'll be taken on a conducted sightseeing tour to points of interest around town. At 11:30 in the forenoon they'll be guests of Radio Station WJPS's "Cinderella Weekend" for the weekly give-aways.

To See Ceramics Made

Next morning the women visitors will board chartered buses for a trip to the Engle Studio at Newburgh. Walter Messick and Dana Cope, partners in the business and members of the host chapter, will show them how California-type ceramic figures and artware are molded, decorated, glazed, fired, and packed for shipment. And what bargain hunting female can resist the opportunity to pick up rejects, discontinued items, and show samples at a fraction of their retail value!

Dress Up for Street Carnival

Here's something for the whole family. All week Evansville will be merry-making at the West Side Nut Club Fall Street Festival. Saturday night is the big windup with a parade, floats, entertainment, and prizes for costumes.

Togged out in Western duds, the West Siders will sport beards grown for the occasion. Business houses in the seven-block, closed-off area beginning at West Franklin Street and Ninth Avenue will look like a frontier town movie set.

So dress up, or down, and get into the act. Maybe you'll win a prize. Anyway you'll have fun.

Now to finish up the weekend. On Sunday you can drive down to the Dress Plaza that keeps Ol' Man River out of Evansville's front yard and watch the fascinating marine traffic—sternwheeling excursion ships, sturdy towboats pushing freight-laden barges, tugs, pleasure craft.

Follow the cargoes over to the Mead Johnson Terminal at St. Joseph and Ohio streets. As the barges glide under this most modern and flexible of river-rail-truck terminals, notice the ease with which they are unloaded or loaded to or from motor carriers or rail cars.

A "Ship" Full of Monkeys

Then continue out St. Joseph to Mesker Park. The kids will love the *Santa Maria* ship monkey house and other zoo features. You can shoot some golf, fish, stroll through the sunken garden, or enjoy "Coney Island." Oh—camera, color film, of course!

Or you might like to cross the east side to Evansville College. Its recently added Engineering and Science Building has a Machinery Hall for large testing instruments, is the center of the institution's industrial research. If the college museum is open, you can look

(Continued on page 76)

Reserve Hotel Rooms Here — *Order Banquet Tickets Here*

Room Reservation Request

YES, I'm coming to the South Central Area Meeting in Evansville, October 19-20. Please reserve the following accommodations for me at the Hotel Vendome:

No. Rooms	Type Room	No. Persons per Room	Rate Preferred
.....	.....	.....	.....
.....	.....	.....	.....

Arrival Date ..... Time..... Departure Date..... Time.....

Name .....

Street Address .....

City ..... Zone..... State.....

Rates per day — All rooms with bath

Single, from $4.50 — Double, from $7.00 — Twin, from $7.50

Reservations assigned at next available rate when requested rate not obtainable.

Banquet Ticket Order

HERE'S my check in the amount of $..... for..... tickets at $5.00 each for the ASTE banquet at Evansville, October 19.

Meat..... Fish..... How many?

Name .....

Street Address .....

City ..... Zone..... State.....

Do not send currency. Please make checks or money orders payable to the American Society of Tool Engineers.

→ MAIL to: Mr. Charles H. Thuman, General Chairman, c/o Seeger Refrigerator Co., 225 W. Morgan Ave., Evansville 7, Ind.

J. J. Demuth

Gen. M. H. Davis

R. F. Waindle

J. S. Gillespie

F. C. Hockema

Program

South Central Area Meeting

AMERICAN SOCIETY OF TOOL ENGINEERS

October 19, 20, 1951 — *Hotel Vendome, Evansville, Indiana*

Friday, October 19

8:30 A.M.

Registration Opens, Lobby

(Advance Registration 5:00-8:30 p.m. Thursday)

9:00 A.M.

Plant Tours—Bucyrus-Erie Co. and Servel, Inc.

Board of Directors Meeting, Mural Room

1:30 P.M.

Technical Session, Empire Room
Chairman, Gardner Young, Tool Supervisor, Westinghouse Electric Corp., Pittsburgh, Pa.

Developments in Carbide Tools and Dies, James S. Gillespie, Manager of Production Sales, Carboloy Dept., General Electric Co., Detroit, Mich.

3:30 P.M.

Discussion Panel, Empire Room

Moderator, Roger W. Wallace, Technical Superintendent, Sangamo Electric Co., Springfield, Ill.

The Tool Engineer's Professional Status

Panel Members: Howard C. McMillen, Plant Manager, Philco Corp., Bedford, Ind.; Gordon Swardenski, General Superintendent, Planning Dept., Caterpillar Tractor Co., Peoria, Ill.; William L. Dolle, President, Lodge & Shipley Co., Cincinnati, Ohio; Willis G. Ehrhardt, Partner, Ehrhardt Tool & Machine Co., St. Louis, Mo.; Halsey F. Owen, Associate Professor, Industrial Engineering Dept., Purdue University, Lafayette, Ind., and George C. Tillotson, Sales Engineer, Delco Products Div., General Motors Corp., Dayton, Ohio.

Friday, October 19

7:00 P.M.

Banquet, Empire Room

Introduction of National Officers and Directors

Tools, Tactics and Techniques
An address by Frank C. Hockema, Vice-President and Executive Dean, Purdue University, Lafayette, Ind.

Choral Selections by the Society for the Preservation and Encouragement of Barber Shop Quartet Singing in America, Inc.

Specialty Numbers by the S.P.E.B.S.Q.S.A. Songfellows and Dixieliners quartets.

Conducted by Jerry Beeler, Past National President of the organization, and General Manager of the Mead Johnson Terminal Corp., Evansville.

Saturday, October 20

9:00 A.M.

Technical Session, Empire Room

Chairman, Roger F. Waindle, Second Vice-President, ASTE.

Tools and Methods for Defense Production, Gen. Merle H. Davis, Chief of Ammunition Branch, Industrial Div., U. S. Army Ordnance, Washington, D. C.

Round Table Discussion of Society Aims and Problems, Chase Room

Moderator, J. J. Demuth, ASTE President
National officers and national committee chairmen will meet with area chapter officers or their representatives.

R. W. Wallace

Gardner Young

Ladies Program

Friday, October 19

9:00 A.M.

Conducted Sightseeing Tour

11:30 A.M.

Visit to "Cinderella Weekend" Program, Radio Station WJPS

7:00 P.M.

Banquet, Empire Room

Saturday, October 20

10:00 A.M.

Chartered bus trip to and tour of Engle Studio, Newburgh, Ind., ceramic artware plant and showroom

For Everybody

Saturday Evening

Evansville's Annual West Side Nut Club Fall Street Festival—Parade, floats, costume prizes, entertainment

In seven-block, closed-off area, beginning at West Franklin and Ninth Avenue

Bring the family, wear your Western togs, join the fun, win a prize.

Area Meeting Committee

Charles H. Thuman
General Chairman
Evansville

Henry J. Pernicka
Vice-Chairman
Evansville

Lawrence R. McAfee
Dayton Chapter Chairman

Edgar L. Routzong
Cincinnati Chapter Chairman

Dezell Gibbs
Richmond Chapter Chairman

H. Leslie Mendenhall
Muncie Chapter Chairman

James H. Clark
Decatur Chapter Chairman

William D. Wuest
Louisville Chapter Chairman

A. Scobey Rogers
Nashville Chapter Chairman

L. W. Greenblatt
St. Louis Chapter Chairman

Ernest W. Hilkenbach
Indianapolis Chapter Chairman

Duane H. Brighton
Peoria Chapter Chairman

Roger W. Wallace
Springfield (Ill.) Chapter Chairman

Advisory

Howard McMillen
Frank J. Hausfeld
Walter P. Schneider
Evansville

Host Chapter Arrangements

Technical Division

Clyde Yost
General Chairman

Plant Tours
Harry Ferguson

Social Division

Walter V. Stippler
General Chairman

Banquet Speaker
Harry Newcomb

Banquet Arrangements
John Race

Banquet Entertainment
Joseph Novak

Ladies Activities
Walter Messick

General Division

Paul W. Vierling
General Chairman

Registration
Joseph Halbig

Reception
Roy Ackerman

Signs and Tickets
Joseph Waltman

Budget
Arthur H. Ullman

Photographic
Ralph Gordon

Film Projection
Adam Linegar

Correspondence
Bernard E. Pampe

Evansville chapter, Society for the Preservation and Encouragement of Barber Shop Quartet Singing in America

(Continued from page 73)

over its 5000 Indian relics from the Mound Builders who once inhabited this region.

As another alternative, you could strike southeast through Sunset Park and over the bridge to the high red bluffs of Henderson, Ky. As you explore the state park, bird refuge, and museum named in his honor, you'll be reminded that John James Audubon ran a store and a mill, kept a turtle and frog pond there.

The naturalist was a contemporary of Colonel Hugh McGary across the river. If the colonel could do a Rip Van Winkle, he'd be flabbergasted. When he built a cabin in 1812 on the Indiana side of the Ohio, he had no intention of founding a town. He merely thought it would be handier to get to his in-laws over in Henderson (then Red Banks) than by hiking from his home 30 miles north at Princeton.

The old pioneer probably never suspected that he was settling on the edge of the biggest strip coal mine in the country, nor that his property would be the "capital" of a three-state oilfield.

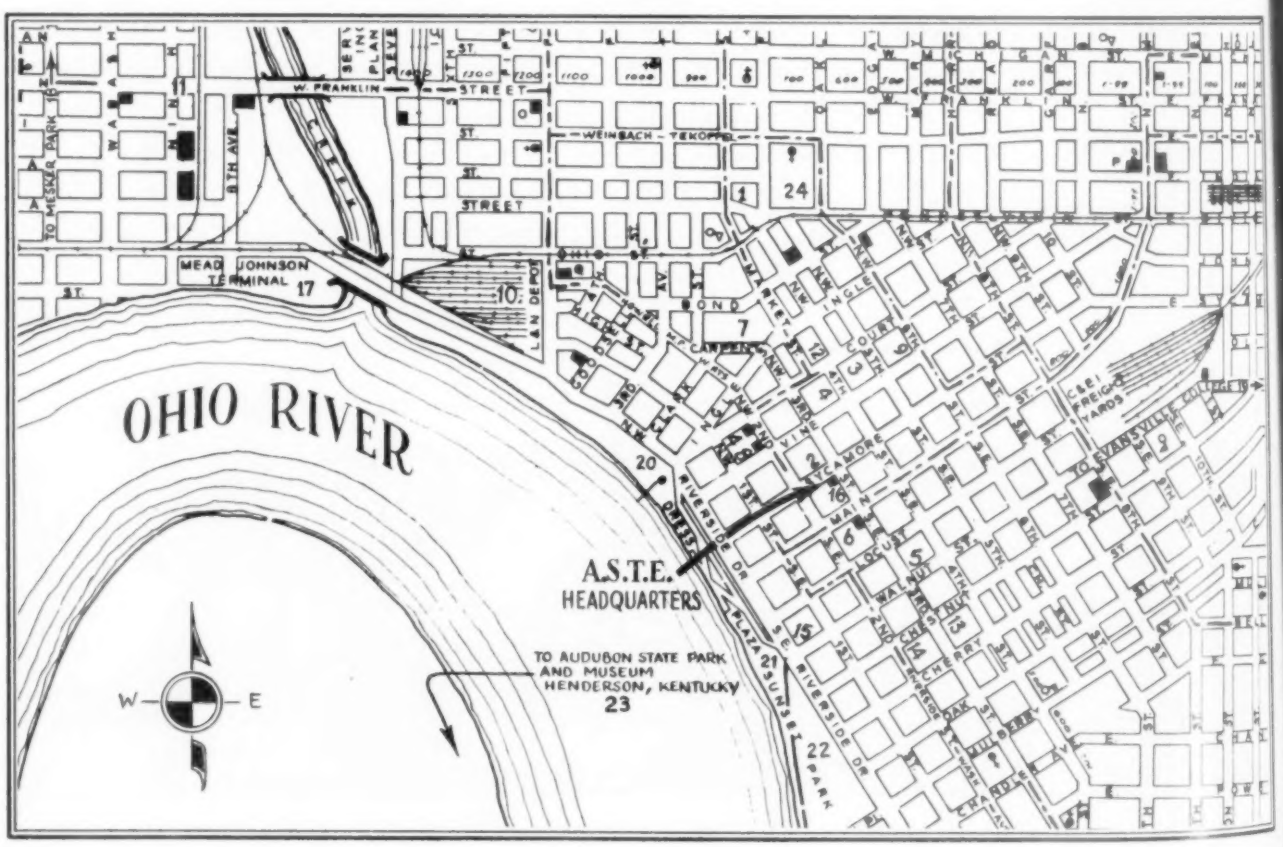
When the Hoosier soldier sold off a portion of his holdings to General Robert Evans, he didn't dream that it would become the site of busy factories making bottles, baby foods, grain and meat products, uniforms, cigars, automobile bodies and headlights, tools, plastic moldings, revolving doors, airplane hangars, farm implements, prefabricated steel buildings, packaged kitchen and bathroom units. In fact he had never heard of some of these things.

Colonel McGary can't see the city he founded. You can. So take this made-to-order opportunity to learn more of your country and of your ASTE. Use the form on page 73 to tell the committee what accommodations and how many banquet tickets you'll need. Before you forget.

Left: Like these kids, visiting ASTE youngsters (adults, too) can go Western at the West Side Nut Club's Fall Festival. Right: Attracting some 75,000 spectators, a big parade will climax the week-long annual street carnival the Saturday evening that ASTE is in town.

Places to See, Where to Find Them

1 Municipal Market
2 Greyhound Bus Terminal
3 Court House
4 Museum of Fine Arts
5 City Hall
6 Chamber of Commerce
7 Willard Carpenter Homestead
8 Y.M.C.A.
9 Y.W.C.A.
10 L. & N. Railroad Depot
11 West Side Nut Club Fall Festival
12 Coliseum
13 Masonic Temple
14 Scottish Rite Cathedral
15 Hotel McCurdy
16 Hotel Vendome, ASTE Headquarters
17 Mead Johnson Terminal
18 Mesker Park
19 Evansville College
20 Pumping Station
21 Dress Plaza
22 Sunset Park
23 Audubon Museum
24 Willard Library



J. J. Demuth, ASTE president, presents Albuquerque charter to J. F. Durrie, chairman of the new chapter. At left and right: F. H. Deiber, treasurer; O. C. Lackey, first vice-chairman; D. B. Kennedy, second vice-chairman, A. E. Hall, secretary. Below: Part of the dinner group attending charter ceremonies. Upper right: Los Alamos launches innovation by inviting ladies to its chartering. Below: The newly installed officers plan the year's activities. From left: N. C. Blezek, first vice-chairman; W. A. Wilson, second vice-chairman; J. A. Parks, chairman; W. L. Hoffman, secretary, and W. C. Moxley, treasurer.

Tool Engineers in New Mexico Atomic Centers Organize Chapters

ASTE is giving the world substantial evidence that tool engineers are helping atomic energy come of age as a manufacturing industry. During the first week of August the Society chartered 132 members of the Albuquerque and Los Alamos government installations. Founded in the organization's 20th anniversary year, the New Mexico chapters are the 92nd and 93rd to be established in North American industrial centers.

The Albuquerque group held its charter ceremonies on August 3rd at the Franciscan Hotel with an attendance of 65. After welcoming the members and visiting officers, Jerome F. Durrie, chairman pro-tem, turned the meeting over to Harry E. Conrad of Detroit, executive secretary.

Mr. Conrad conducted an election of officers, appealed for membership support, and commented on ASTE's prominence in industry and its headquarters activity.

President Swears in Durrie

President J. J. Demuth of St. Louis administered the oath of office to: Jerome F. Durrie, engineering designer, Sandia Corp., chairman; Orth C. Lackey, production engineer, Maisel's Indian Trading Post, first vice-chairman; Douglas B. Kennedy, machine designer, Sandia Corp., second vice-chairman; Allen E. Hall, secretary, and Fred H. Deiber, treasurer, also of Sandia Corp.

Mr. Demuth presented the charter to Chairman Durrie and spoke inspiringly on the purpose, aims, and accomplishments of the Society. Mr. Durrie's symbol of office was conveyed in the presentation of a chairman pin by B. J. Hazewinkel, Denver director.

The new chairman thanked everyone concerned for assistance in forming the chapter, adding that the drive for new members would continue. Future meeting, he announced, will be held on the first Friday of the month.

Baecker Receives Membership Kit

On behalf of the National Membership Committee, H. B. Osborn, Jr. of Cleveland, national assistant secretary-treasurer, presented a work kit to Harold Baecker, a Sandia Corp. tool engineer who heads up the membership activity. F. J. Geoffroy, Denver chapter vice-chairman, was awarded a "Tool Engineers Handbook" for his efforts in recruiting members for the new chapter.

At the conclusion of the formal charter service, Third Vice-President Thomas J. Donovan, Jr. of Philadelphia, tested the technical knowledge of the audience with his "Silver Dollar Quiz."

Other members making up the charter roster of 60 are: Walter L. Cole, James A. Ford, Edward J. Kobiela, Harry M. McNeill, Arthur W. Miller, Norbert K. Molter, John H. Murphy, Francis Patterson, William I. Porter, Crawford B. Saunders, Robert L. Siglock, John L. Veeneman, Claude C. Whitney, Herbert E. Anderson, John F. Campbell, Jr., Thomas F. Corrigan.

Arthur R. Eiffert, Jack F. Hammerstran, Hubert R. Hanen, Gerhard F. Heckman, Robert S. Hewitt, Edward S. Moore, Edward C. Neidel, Jr., Olav O. Nerhus, George Neun, Kenneth G. Overbury, Marvin D. Ozmun, John T. Risley, Bennie J. Russo, Robert L. Thomas, Chester A. Washburn, and William N. Yates, all of Sandia Corp.

Victor V. Benischek and James E. Bomboy, Benischek Mfg. Co.; James Leseney, Consolidated Machine & Supply Co.; Norman L. Shell, N. L. Shell Co.; James R. Felter, Efficient Engineering Co.; Claude M. Flick, Machine Engineering Service; Seymour L. Maisel, Maisel's Indian Trading Post; Kurt R. Schikowski, American Machine & Foundry Co.

Everett M. Wilson, Industrial Supply Co.; Francis D. Simpson, Gorman Engineering Co.; Harry Wilson III, Geoffroy Co.; Col. William N. Dettore, Kirtland A.F.B., Kirtland Field, and Joseph J. Stribling, University of California, Sandia Base.

Los Alamos Officers Look On

Guests included Joseph A. Parks and Norman C. Blezek of Los Alamos, for whom the function was a preview of their own chartering, August 6.

THE LOS ALAMOS Civic Club in the Atomic City was host that evening to 95 members, women guests, and out-of-town officers. This occasion was unique in two respects: all members of the chapter are employed under the auspices of one organization, the Atomic Energy Commission; and it is the only ASTE chartering ever witnessed by wives of members.

Mr. Conrad welcomed the gathering and presented the slate of previously chosen officers for membership approval. Following their unanimous ratification, President Demuth swore in the officers. They are:

Joseph A. Parks, tool engineer, Uni-

versity of California Research Laboratory, chairman; Norman C. Blezek, Standard Engineering & Mfg. Co., first vice-chairman; William A. Wilson, also of the University of California, second vice-chairman; Wilber L. Hoffman, secretary, and William C. Moxley, treasurer, both engineers with the University of California.

The new chairman accepted the charter from the president and received his chairman pin from Director Hazewinkel.

Vice-President Donovan presented a membership kit to Harry Gregersen, University of California tool designer, and promised a return appearance with his quiz program.

Awarded ASTE Handbooks

For their membership work Mr. Gregersen and Mr. Moxley were recognized with copies of the "Tool Engineers Handbook," presented by Vice-Chairman Geoffroy from Denver.

The program concluded with a talk on Induction Heating by H. B. Osborn, Jr., who is technical director for the Tocco Div. of Ohio Crankshaft Co., Cleveland, Ohio.

The 81 members who signed the charter include: Gene M. Barrington, Roy R. Beckham, John E. Boyer, Robert I. Brasier, Harry C. Brockmann, John I. Campbell, Leonard Crogstad, Charles R. Ewert, Martti O. Haglund, Ariel E. Hansen, Melvin L. Hawkins, George J. Hofreiter, Stanley G. Johnstone, Philip W. Kazmier.

* * *

Oral O. Kerns, Robert H. Moeller, Austin M. Morgan, Donald W. Niemand, Julien A. Patenaude, Richard T. Schmitt, Donald F. Silver, William H. Strube, Sr., Robert F. Wendler, Herbert L. Wheitsel, Robert J. Adams, Gordon H. Anderson.

Edward A. Anne, Frank Barylski, James J. Bramble, Brandon Bronnenberg, William W. Burk, Ellis L. Byers, Frank E. Caskey, John L. Chambard, Lemoyne J. Chambard, Joseph D. Cunningham, Juan A. Doyen, Wade E. Dunwoody, Floyd L. Evans, Hannibal M. Fraga, Harry C. Fricke, Richard J. Gagne.

* * *

Dale H. Gunn, Howard E. Hathaway, Harold H. Hawk, Oliver C. Heustis, John T. Jezek, Jerome A. Johnson, Richard W. Kania, Donald R. Kirts, John A. Lacombe, Peder J. Ljosdal, Kenney E. Laughlin.

Frank J. Miller, Clifford E. Nilsson, Glenn E. Quillin, Joe E. Quintana, John A. Richards, Gerald B. Rogers, Philip H. Rogers, Herman A. Rothman, Jr., Henry B. Rudolph, James E. Runyan, Elmer H. Ryman, John B. Schroer, Robert L. Smiley, Richard Y. Smith, Robert G. Smith, Allan G. Spooner, Edward J. Wiewandt, and Kenneth F. Wiley, all of University of California.

Virgil B. Brown, Atomic Energy Commission; Chester S. Kazek, Sr., Hanna Engineering Works; Roy Stenholtz, Wright & McGill, and David B. Tod, Los Alamos Scientific Laboratory.

Two University Students Win Detroit Scholarship

Detroit, Mich.—Detroit chapter has awarded its first annual scholarships to two university students specializing in tool engineering.

The chapter is sponsoring tuition for

W. H. Paul

L. E. Linden

William H. Paul, a University of Detroit senior, and Lars E. Linden, who is entering the University of Michigan.

Mr. Paul is a graduate of Moosehart High School, Moosehart, Ill., while Mr. Linden is an alumnus of the Wilbur Wright Vocational High School in Detroit. He is affiliated with the Detroit ASTE student section.

The Scholarship Committee administering the awards is composed of Monta Cox, Andrew Carnegie, and Charles Smilie, all former chapter chairmen. The scholarships were established under the direction of the Education Committee, headed by Stanley C. Phillips, and recent executive committees.

Jaycees Want Candidates For Young Men of Year

Tulsa, Okla.—The ten outstanding young men of the year are being sought by the United States Junior Chamber of Commerce.

Each year the Jaycees make a regular and systematic search for men up through 35 years of age, who have made exceptional contributions to the welfare of their community and nation. Purpose of the recognition is to give the world concrete evidence that success in the American free enterprise system still is available to those individuals who strive to achieve.

Perhaps you know someone in the Society eligible for nomination. Then ask the Internal Affairs Department, United States Junior Chamber of Commerce, P. O. Box 7, Tulsa, Okla., for a nomination blank and submit your candidate.

Deadline for nominations is November 1. A banquet honoring the ten young men selected will be held January 20, 1952, in Dayton, Ohio.

McMillen Will Manage Bedford Philco Plants

Bedford, Ind.—Howard C. McMillen, general superintendent of Seeger Refrigerator Co., Evansville, has accepted a position as manager of the Bedford plants of Philco Corp.

Mr. McMillen is national treasurer of the Society and was formerly national finance chairman and chairman of Dayton and Evansville chapters.

A Purdue mechanical engineering graduate, he was associated with Frigidaire Division of General Motors Corp. at Dayton, Ohio, before going to Evansville with Seeger.

Los Angeles Entertains Ladies at Summer Dinner Dance

The Deauville Beach Club at Santa Monica was host to 290 Los Angeles members, guests, and their ladies for a summer dinner dance, August 10. Ralph Chrissie (inset), first vice-chairman, handled arrangements for the outstanding social event. Ivan Scott's orchestra furnished dance music and accompanied impromptu barber shop quartets.

ondson Announces National Scholarship Winners

Detroit, Mich.—Recipients of the So- first national scholarships have announced by National Education man Jay N. Edmondson, a pro- in the Production Division at the State University College of En- ring, Columbus, Ohio.

winners are: William H. Garlock Joseph, Mo., a University of Kan- ndergraduate; James A. Rich- Marion, Iowa, student at the

P. Ryan

J. A. Richmann

J. W. Boring

W. H. Garlock

versity of Iowa; William P. Ryan of llingdale, Pa., who attends Villanova llege, and John W. Boring, a Uni- sity of Kentucky man from Lexing- , Ky.

A member of the ASTE student p at his school, Mr. Garlock says, My main interests . . . are in tool and t design . . . Without good tool sign, a plant cannot attain maximum ficiency. I hope to be able to help the ogress in this field."

Likes Challenging Problems

Planning and devising methods for nufacturing machine parts, automa- production equipment, new pro- ses, and production of parts present- difficult problems, are Mr. Rich- nn's goals. His interest in these lds has been aroused "through prob- s encountered during industrial em- yment and from similar work at the iversity."

Mr. Ryan feels that "tool engineering one of the outstanding factors con- uting to the success of American dustry and one of the most opportune ases of the engineering profession." arded a $500 scholarship by the iladelphia ASTE chapter, he has me in contact with many tool en- eers and learned as much as pos- le about this field, in reading and rough attending meetings of this apter."

Cutting tool design is the specialty pealing to Mr. Boring. "Most of the search so far has been done in the sign and testing of lathe tools, par- ularly the materials used in making ese tools. There seems to be greater om for improvement in the materials ed in these tools than in the actual sign of the tools," he believes.

"In making the awards," Professor Edmondson explains, "the committee considered scholarship, personal qualities, and recommendations of the student's faculty or of the ASTE chapter Education Committee in his vicinity.

Geographical distribution also entered into the selection. A fifth award is to be made this fall to a worthy Canadian student.

Candidates were limited to fourth or fifth year students, attending institutions accredited by the Engineers Council for Professional Development and evidencing interest and aptitude in one or more such subjects as Metal Processing, Plant Layout, Tool Design, Inspection, and Manufacturing Processes.

The grants will be made in quarterly payments of $100, or $150 per semester, to a maximum of $300.

"Each of the boys chosen," Professor Edmondson adds, "earns at least part of his college expenses. In addition to sustaining himself, one winner reports being 'able to loan my father $700 a year ago.'"

Truscon Appoints Black

Detroit, Mich.—R. D. Black, program chairman of the Waterloo Area chapter, has accepted a position as assistant to the advertising and sales promotion manager of Truscon Laboratories.

Before joining Truscon, Mr. Black was advertising manager for American Broach & Machine Co., Ann Arbor. Since he will reside in the Detroit area, he is resigning his office in the Waterloo ASTE chapter.

Fuller Tool in New Plant

Detroit, Mich.—Founded and operated by six brothers, Fuller Tool Co. has moved into a new, two-story plant at 4000 West Eleven Mile Road, Berkley.

Two of the brothers, William and Walter, are members of the Detroit ASTE chapter. The other partners are James, Edward, George, and Ernest Fuller.

The company will use the latest equipment and techniques to make high-speed steel and carbide-tipped cutting tools to customers' specifications.

Penn Wins $2500 Award For Tooling Suggestions

Indianapolis, Ind.—The second person to receive his company's top award for employee suggestions, Joe Penn, tool engineer at the Speedway plant of General Motors' Allison Division, recently received a $2500 check.

In 1945 Mr. Penn suggested that tool routing sheets carry drawings illustrating the instructions. At that time the company rejected the idea as too costly to be practical. But two years ago they decided to try it out. Since then the aircraft engine firm has saved enough in tooling and production costs to warrant payment of the award.

Allison tool routing sheets now incorporate pictures of a part as it looks at each operation. Processors, tool designers, production workers and inspectors can quickly visualize what is to be done.

Drawn in the tool design department, the pictures are completed by the processor. They eliminate confusion in interpreting routings converging on manufacturing departments.

In addition to being secretary of the Indianapolis ASTE chapter, Mr. Penn is a member of the Society's National Editorial Committee.

Need an ASTE Chapter?

Are you too far from the nearest ASTE chapter to attend meetings conveniently? Does your area have a substantial member potential? Then write to Andrew B. Clark, national membership chairman, in care of Society headquarters at 10700 Puritan Ave., Detroit 21, Mich. He'll put you in touch with any members in your vicinity, and send you literature and other helps in forming a chapter.

Presents Membership Kit

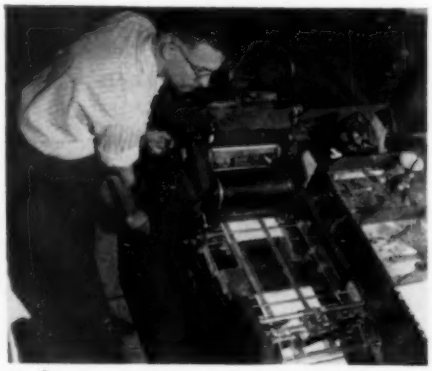
A. B. Clark (right), national membership chairman, presents one of his committee's kits to Robert Southwell (second from left), Cleveland chapter chairman. Other members of chapter executive committee are, from left: Jack Schron, Andrew Cirbus, Glenn Hier, Harold Hausrath, Gordon Carlton, and H. B. Osborn, Jr. The group enjoyed golf and dinner at the Shaker Heights Country Club as guests of Mr. Osborn, Mr. Hier and Owen Harvey, membership chairman.

Your Society Is Big Business

EVER THINK of what's behind the services you receive from your Society? Or of the busy, unseen hands that bring them to you? If you've never had an opportunity to visit the ASTE building in Detroit, you can hardly visualize the volume of business going through it.

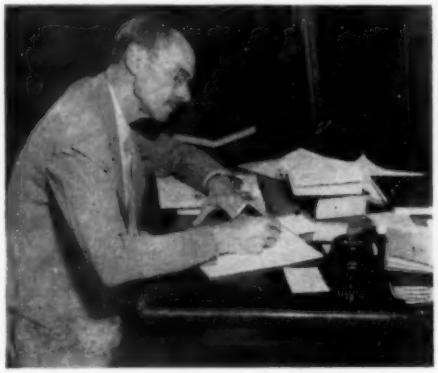
Especially in an exposition year when the mail room is stacked ceiling-high

Left: Millions of pieces of paper go through this multilith machine annually to reproduce letterheads, office forms, and processed communications to members and officers. Harold Kull starts a run of semi-annual reports for a national committee. Center: Using an eight-inch high roster of Society members, Joan Romer compiles a monthly membership chart showing the status of chapters under each area membership captain. Right: Sarrah Cooks (left) and Jacqueline Rupert label the envelopes that brought this issue of *The Tool Engineer* to you and to all other readers. These girls work two days to address enough wrappers for one issue.



Left: Dorothy Granfield, accounting department typist, writes the hundreds of checks that help make the ASTE account the busiest and largest in the branch bank where the Society keeps its funds. Center: Preparing a month-end balance sheet informing chapters of the organization's financial condition is part of Accountant Harry Anderson's job. Right: For each ASTE member Alice Headley of the tabulating department keypunches three cards with address and billing information. There are from 200-500 new members per month.

Left: A newcomer to the headquarters staff, John Holt, assistant to the book editor, compiles a glossary for the 650-page ASTE Handbook on Metal Stamping Dies now in preparation. Center: One of the approximately 1000 drawings to be included in the die manual is scaled by Frank W. Wilson, editor. Right: His secretary, Mary Bonadeo, proofreads a bulletin on new speakers, issued by the National Program Committee.



printed matter; when exhibit floor
paper the walls of the conference
when reams of copy come out of
Engineer typewriters.

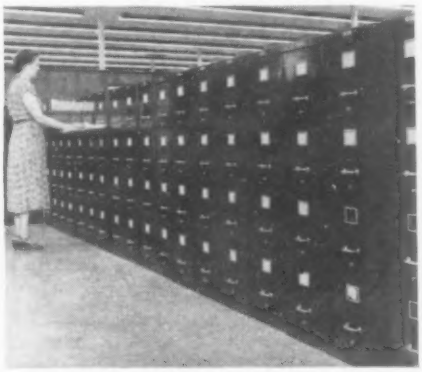
STE does more than preach mass
duction. The Society practices it in
preaching. To give you prompt service, headquarters has fast, automatic machinery performing addressing and billing operations, and compiling business records.

And there is little down time for the electric multilith machine. It usually runs to capacity reproducing printing and typewriting. With a mailing machine information can be distributed almost simultaneously to the entire membership.

ASTE is big business. The pictures on these pages tell our story.

Left: Harry Conrad, executive secretary, dictates acknowledgment of some of the 250 applications for space at the 1952 Tool Engineers Exposition, to Jeanne Barman, his secretary. Center: John Eacock, assistant to Mr. Conrad, discusses with a letter shop representative a mailing to prospective show exhibitors listed on the yards of fanfold form he holds. A floor plan (on desk) will accompany the invitation to participate in the Society's biennial tool show. Right: Guided by key-punched cards, this automatic machine addresses 80 labels per minute for *Tool Engineer* magazine wrappers. Archie Knight of the tabulating department inspects the ink impression during a three-day run of nearly 20,000 stickers.

Left: All proposed data sheets are checked with the National Standard Committee's specifications, by Calvin Burke, the committee's secretary. Center: Responsibility for keeping hundreds of thousands of papers available rests with Genevieve Lawson, filing supervisor. This bank of files is only part of the equipment required for storing member and other active records. Right: Along with other services rendered to chapters and members, Lois Bramble, secretary to Mr. Eacock, makes out a shipping order for supplies.



Burke Appointed Secretary To Standards Committee

Detroit, Mach.—C. T. Burke of Detroit succeeds R. L. Tull, who has resigned, as secretary to the National Standards Committee at ASTE headquarters.

Over the past six years Mr. Burke has had a wide range of experience in clerical, production, distribution, and sales capacities.

Prior to this he was a member of the Royal Canadian Air Force. After a wartime interruption of his engineering studies, he resumed his education, majoring in business administration.

Explains Oil Hydraulics From T.E. Standpoint

Long Beach, Calif.—Using chalk diagrams of basic hydraulic circuits as applied to machine tools, James T. Clark, application engineer for Vickers, Inc. Los Angeles office, pointed out to Long Beach members the most frequent sources of trouble in such systems.

Mr. Clark described the function and selection of oil hydraulic components at the August 8 chapter dinner meeting at the Coast Inn. He detailed the "unloading" circuit, reservoir tank design, heat losses, and proper use of sequence, check, relief, and control valving.

Tool Engineer Appoints Kimmel Associate Editor

Detroit, Mich.—Robert T. Kimmel of Pittsburgh has joined *The Tool Engineer* staff at Society headquarters as associate editor.

Employed by Westinghouse Electric Corp., East Pittsburgh, Pa., since 1944, he has worked in the public relations department of the technical press section, in the instruction book section, and most recently, in the Air Arms Division as technical editor and writer.

Mr. Kimmel is an industrial engineering graduate of Penn State.

Coming MEETINGS

CHICAGO—October 27. ASTE Seminar, University of Illinois, Urbana, Ill. (See program in September issue.) March 17-21, 1952. Tool Engineers Industrial Exposition and 20th annual Society meeting.

CLEVELAND—October 12. Speaker: A. T. Colwell, vice-president, Thompson Products, Inc., TAPCO Div., Cleveland. Subject: "The Revolution in Aircraft Power Plants." November 9. Speaker: Harry Conn, chief engineer, Scully-Jones & Co., Chicago. Subject: "Production Tooling Problems."

COLUMBUS—October 10. Technical Session. November. All-Council meeting.

DETROIT—October 11. Engineering Society of Detroit. Subject: "Cold Extrusion Dies." November 8. Standards and Nominating committees. Student Section: October 18. Plant Tour. November 15. Subject: "Motion and Time Study."

EVANSVILLE—October 19-20, Hotel Vendome. South Central area membership meeting and semi-annual meeting of board of directors. Technical sessions, plant tours, banquet.

LANCASTER, GREATER—October 16. Speakers: L. K. Behr, district manager, and E. L. Hurst, Philadelphia district field engineer, Norton Co. Subject: "Abrasives and Their Uses." November 20. Speaker: G. E. Brumbach, Carpenter Steel Co., Reading, Pa. Subject: "Application of Tool Steels."

LOS ANGELES—October 11. Speaker: T. J. Donovan, Donovan Co., Philadelphia, Pa. Subject: "Common Sense in Heat Treating." November 17, 8:00 p.m., Hollywood Roosevelt Hotel. Joint meeting of West Coast chapters and Ladies Night, with national officers present. Speaker: Dr. Howard F. Seifert, Jet Propulsion Laboratory of California Institute of Technology. Subject: "Rockets and Guided Missiles."

MILWAUKEE—October 11, 6:30 p.m. Plant Tour, International Harvester Co.

MONTREAL—October 11, 7:45 p.m., Canadian Legion Hall. Speaker: George Eglinton, sponsored by A. C. Wickman Co., Ltd. Subject: "Carbide Dies."

MUNCIE—October 2. Speaker: A. D. Moncrieff, assistant chief engineer, and Harry Pelphrey, research engineer, Michigan Tool Co. Subject: "Hobs and Hobbing in High Production."

NEW HAVEN—October 11. Plant Tour, Greist Mfg. Co. November 8. Speaker: A. H. d'Arcambal, vice-president, Pratt & Whitney, Div. Niles-Bement-Pond Co., West Hartford, Conn.

SCHENECTADY—October 11. Speaker: Harry L. Stewart, Logansport Machine Co., Inc., Logansport. Subject: "Fluid Power in Action." November 8. Speaker: Arthur R. Tobin, Fellows Gear Shaper Co., New York office. Subject: "Highlights of the Art of Generating and Gear Manufacturing Equipment."

TORONTO—October 3. Speaker: George Eglinton, Lincoln Park Industries, Inc., Lincoln Park, Mich. Subject: "Carbide Die Design." November 7. Speaker: P. Leckie-Ewing, Union Twist Drill Co., Butterfield Div., Rock Island, Que. Subject: "What's New In Cutting Tools."

TULSA—October 11. Speaker: Nathan Janco, president, Centrifugal Casting Co., Tulsa. Subject: "Centrifugal Castings."

(WASHINGTON, D. C.) POTOMAC—October 4, 6:45 p.m., Annapolis Hotel. Speaker: W. R. Plummer, vice-president, Progressive Welder Sales Co., Detroit, Mich. Subject: "Design for Resistance Welding."

WINDSOR—November 12, 6:15 p.m., Prince Edward Hotel. Talk and films on Sundstrand lathe and milling operations, sponsored by Alison Machinery Co., Ltd. Speaker to be announced.

Obituaries

William H. Nichols

William H. Nichols, prominent Waltham industrialist, inventor, and president of W. H. Nichols Co., died August 9 at his home in Waltham, two days after his 78th birthday.

Noted as a New England inventor, he designed the Zenith rayon pump, the Gerotor pump, and the Nichols hand miller. His interests and hobbies included early machine tools, watchmaking machinery, antique clocks and watches.

Born in Hamilton, Ont., Mr. Nichols entered business at 16, operating a bicycle building and repair shop. As a bicycle racer he established a world's record for the quarter-mile.

He served his toolmaking apprenticeship at the Pratt & Whitney plant, was subsequently employed at the Stanley Works, the Veeder Corp., and American Watch Tool Co.

His first real shop was started in cellar of his home in 1902. After eral moves and expansions, he e lished the present factory at 48 W Avenue. During both world wars plant turned out aircraft equipme

The National Association of M facturers gave Mr. Nichols one of i "Pioneer Awards," presented to England inventors.

He was affiliated with the B ASTE chapter as are W. Hart and thur A. Nichols, the two sons who vive him. He was also a member of Newcomen Society of Engineers the New England Live Steamers.

Frank Foote

Frank Foote, 69, president of M Machine Co., Inc., South Bend, I passed away August 9. He was a cha member and past chairman of the S Bend Tool Engineers.

A native of Cadillac, Mich., Mr. F was employed by Dodge Mfg. Co. Gillette Motor Co., both of Mishawa Ind., before joining the J. D. Ma Co. in 1919. Two years later he beca a partner in the business he headed the time of his death.

He was a director of the Natio Tool and Die Manufacturers Asso tion, was active and held office several civic organizations.

Earl L. Banks

Earl L. Banks, 50, sales manager the American Twist Drill Co., Detro Mich., succumbed to a heart atta August 28, while in Dayton, Ohio, business.

For the past 22 years Mr. Ban had been associated with Americ Twist Drill in a sales capacity. Pri to that he was with the Ternstedt Di sion of General Motors Corp. He w a member of the Detroit ASTE chapte

ASME Honors Miller With Election as Fellow

Woonsocket, R.I.—Paul V. Mille manager, Small Tool and Gage Di The Taft-Peirce Mfg. Co., Woonsocket is one of eight men recently elected t the grade of Fellow by the Americ Society of Mechanical Engineers.

To be eligible for the honor co ferred on the Boston ASTE chapte member, an engineer must have reco nized professional attainment, 25 year of active practice or teaching expe ience in a school of accepted standing and 13 years' membership in ASME.

Promotion to Fellow is by election o the council, supreme governing body of the society, upon nomination by fe Fellows or members of ASME.

News in Metalworking . . .

METHOD X — DEVELOPMENT FOR MACHINING SUPER ALLOYS

Metal removal through a method employing the direct utilization of electrical energy for the machining of any electrically conductive material has been developed and made available to the metal working industry. The Method X machine removes metal in a directed manner by means of an electric spark discharge which does not otherwise affect the work material's physical or chemical characteristics. The process is made available through the Method X Corporation of Philadelphia, an affiliate of the Firth Sterling Steel & Carbide Corporation.

Machining action depends on a mechanical, rather than the thermal, effect of electricity which sets up internal mechanical stresses by the use of extremely high current densities and thereby cause the metal particles to detach themselves from the work material without resort to melting. The exposed surfaces thus are said to remain unchanged and surface finishes of 26 micro inches rms are obtainable. Lapping of less than 0.001 in. will produce finishes down to 0.15 micro inches on sintered carbide. Center to center spacing of holes through the same workpiece can be controlled to approximately 0.0005 in. Blind hole fillet radii can be made as small as 0.002 in.

Method Broadens Machining Applications

In the past, fabrication difficulties of sintered carbides, superalloys, S-816, Vitalium and hardened steels has somewhat restricted their uses. Now researchers claim extension for uses of these hard-to-machine metals through Method X process which permits economical and rapid forming of complicated shapes hitherto considered impractical.

An example of this is the materials used for gas turbine blading. Blade root mounting serrations are being ground for the intricate shapes and close tolerances required. Blade sections are shaped by contour milling, precision casting or hammer forging—all relatively slow processes.

Die sections of sintered carbides generally are fastened by means of threaded steel sections brazed into the carbide and secured to the backing blocks by screws. Another means of fastening die sections is to shape, drill and tap wedges to fix the carbide die sections to backing blocks. Both methods are comparatively slow and costly, and may at times leave the mountings subject to loosening due to shocks encountered in service.

Metallurgical research experiments and tests require holes or slices cut in superalloys, high temperature carbides and ultra hardened steels without destroying or changing the exposed surfaces either physically or chemically.

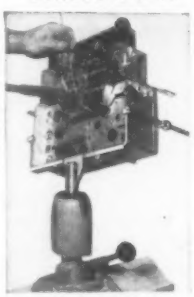
Through the application of Method X to these problems, gas turbine blade contours and root serrations can be more readily shaped and hardness is said to have no effect on machinery speed. Sintered carbide die sections can be bored and tapped so that direct fastening to the backing blocks with machine screws can be accomplished, while complicated geometric shapes can be shaped directly into hard metals.

Engineers claim elimination of the problem of warpage encountered in heat treating steel dies composed of symmetrical hole shapes by first heat treating the solid steel section then machining the desired shapes. Sintered carbides undergo a shrinkage of 15 to 20 percent which is not uniform in all directions and it is therefore, often impractical to form several hole shapes in the half-sintered carbide and then expect hole centers within close measurements. By utilizing Method X, simple geometric shapes can be produced as hardened pieces and then machining of the desired holes can be done rapidly and accurately. Much of the grinding and lapping time usually associated with sectional dies thus can be substantially reduced or eliminated.

The equivalent of machining operations ordinarily accomplished in metal-working such as boring, drilling, tapping, internal and external shaping and engraving by using the electrode as a cutting tool are said to be done more expediently with Method X. In addition, Method X can perform some machining operations not practical on conventional machines.

Cut Your Costs, Too, With
POWRARM
WORK POSITIONERS

HERE'S HOW OTHERS DO IT



POWRARM cuts costs by increasing every worker's productivity. It gives the worker a powerful *third hand* to hold work while two hands produce. That's why POWRARM works on the most efficient assembly lines in America today, and *belongs on yours.* Write us about your production "headache" . . . we'll show you how POWRARM can cure it.

Holds work at any angle in Horizontal, Vertical or Co-axial Plane.

Three sizes of Powrarm — 24 to 150 lbs. capacity.

Write For Catalog 101E
32 informative pages, FREE

WILTON TOOL MFG. CO.
Precision Built Bench Vises, "C" Clamps and Work Positioners
925-H Wrightwood Avenue • Chicago 14, Illinois

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-83

ALLOY CASTING INSTITUTE EXTENDS RESEARCH WORK

In order to aid in meeting mounting defense mobilization needs and other engineering and equipment requirements dependent on the use of stainless steel castings, Alloy Casting Institute has undertaken considerable expansion of its technical research program.

In view of the greatly increased demand for high alloy castings and the concurrent shortages of alloying elements, the Institute's Technical Research Committee is concentrating its alloy conservation studies at Battelle Memorial Institute on high temperature properties of the 21 percent chromium, 10 percent nickel type alloy.

At the same time, development of titanium-stabilized corrosion resistant castings is the subject of investigation to be done at Ohio State University.

Similarly, an extensive study of improved gating systems for high alloy casting production is scheduled as part of the program under way at Massachusetts Institute of Technology, under auspices of the Shop Practice Committee of ACI.

These three activities will be in addition to an extension of continuing research directed toward the improvement of cast alloys widely used in the metals-treating and other industries.

TOP METALMEN TO MEET IN DETROIT AT FIRST WORLD METALLURGICAL CONGRESS

An anticipated 35,000 industry owners, managers, metallurgists and research scientists will attend the first World Metallurgical Congress in Detroit, October 14 through 19, and the National Metals Exposition both sponsored by the American Society for Metals. Dr. Zay Jefferies, retired vice-president of General Electric Company, and a past president of ASM is director general of the Congress.

Included among the participants will be approximately 1,000 metallurgists from 21 nations who will converge on Detroit as a climax to a month of study tours, which covered 57 cities in thirteen states in which more than 100 industries, research laboratories and experimental stations played hosts. The Economic Cooperation Administration set aside more than $500,000 to enable a considerable number of the top metallurgists from Marshal Plan countries to attend the study tours and congress, as part of the Administration's Technical Assistance Program.

Technical sessions for the Congress, which will be held under the leadership of top U.S. metal scientists, will cover conservation of metals and new techniques for processing alloy steels as well as work in nonferrous materials.

Eight major industrial problems are expected to be considered by the assembly. These will include:

1. Need for uniform terminology and research techniques among metal scientists.

2. Lack of a system or agency to translate data from one nation to another.

3. Need for increased means of exchange between scientists engaged in basic research, particularly where their importance to national protection is not involved.

4. Need for accurate knowledge of metal shortages and metal resources according to countries, and the means of relieving them.

5. Insufficient knowledge of the effects of nitrogen and other components in alloy steel.

6. Need for more research on alloy steel behavior at extreme temperatures —particularly for use in jet and fission propelled engines.

7. High cost of new alloys and need for less expensive production methods for such recently developed metals as zirconium, titanium, vanadium, molybdenum and others still in developmental stages.

8. Need for greater knowledge concerning high frequency electric currents in processing metals.

di-acro PUNCH

NEW DOUBLE PURPOSE PRESS

Available in two sizes, 6" and 12" throat depth

Now you can punch holes of various shapes as large as 4" diameter in 16 gauge steel—also blank, draw, emboss, form—all with the new DI-ACRO Punch. It is ideal for both experimental and production work.

The precision ground triangular ram of this double purpose press prevents punch head from turning, assuring perfect alignment at all times for accuracy in duplicated parts.

A Turret Stripper of exclusive DI-ACRO design automatically strips material from punches of all shapes. Roller Bearing cam action develops 4-ton pressure with minimum effort. Adjustable gauges assure exact location of holes.

Send for "DIE-LESS DUPLICATING" *Catalog*

Gives the full story of the DI-ACRO Punch, and also DI-ACRO Benders, Brakes, Shears, Rod Parters, Rollers, Notchers, as well as the new DI-ACRO Vari-O-Speed Powershear and Hydra-Power Bender.

DI-ACRO is pronounced "DIE-ACK-RO"

DI-ACRO PRECISION MACHINES DIE-LESS DUPLICATING

O'NEIL-IRWIN MFG. CO.

375 EIGHTH AVENUE • LAKE CITY, MINN.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-84

JOINT RESEARCH PROGRAM TO STUDY TITANIUM

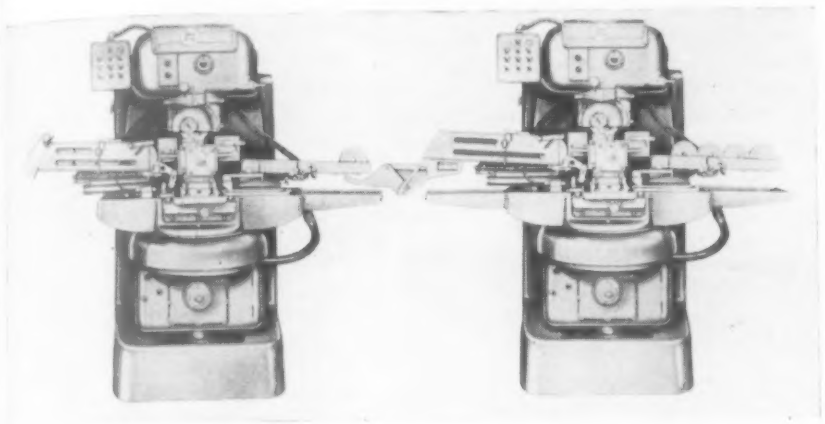
A joint research venture directed toward the development of improved processes for the production of titanium metal was recently announced from Monsanto Chemical Co. and National Research Corp.

Difficulties encountered in the extraction of titanium have effectively reduced the commercial availability of this metal, even though it is one of the earth's most abundant elements. According to Richard S. Morse, president of National Research Corp., titanium and its alloys are "intermediate between aluminum and stainless steel with phenomenal properties of strength and corrosion-resistance. The needs of the present and contemplated military program, as well as increasing peacetime use," he said, "indicate a heavy demand for this extraordinary lightweight metal."

Work initiated by National Research is expected to be considerably expanded under this joint project, which will be directed by Dr. Robert A. Stauffer, vice-president and technical director of the research organization, and by Dr. N. N. T. Samaras, Monsanto's Central Research Department director.

Tools of Today . . . .

Straight Line Automatic Loader



A straight line Automatic Loader has been developed by the National Broach & Machine Co., 5600 St. Jean Ave., Detroit 13, which is said to permit the shaving of all gears of a two, three or four step cluster continuously and automatically by a battery of diagonal shaving machines set side by side in line. The side by side rather than front to back arrangement permits full view of the complete operation for the single operator needed to supply unshaved gears to the magazine feed of the first machine, and to remove the completed gears from the discharge chute of the final machine. All handling between machines is done by automatic mechanical transfer mechanisms. Each cutting cycle is automatic.

The principle elements of the simplified loader include a loading magazine having gravity feed, an intermediate feeder slide and an incline discharge chute. At the completion of a cutting cycle of the first machine which is set up to shave the first gear of a cluster, the cutter stops, the pneumatically actuated tailstock retracts to strip the shaved gear and place it on the unloading finger of the feeder slide which advances, depositing the shaved gear in the discharge chute and simultaneously bringing an unshaved gear from the magazine into mesh with the cutter. Immediately the tailstock advances to engage the new gear, cutter rotation begins and the feeder slide returns to its initial position ready for the next cycle.

The gear deposited in the discharge chute of this first machine is engaged by the fingers of the automatic intermachine transfer mechanism and deposited in the magazine of the next machine in line, which is set up to shave the second gear of the cluster.

The unloading chute of the last machine stores the completed gears until they can be removed by the operator.

T-10-850

Carbide Drill

An unusually designed and operated carbide drill has been developed by the Raymac Manufacturing Co., Inc., 3729 Cass Ave., Detroit 1.

The drill's efficiency is said to be derived from the shape of the flute and the way the drill is pointed. Chips that are turned out, are not discolored by heat, and tend to prove the statement that the drill cuts rather than fuses through metal.

The drill operates at lower speeds than many standard drills. For example, the Raymac ¼ in. drill, drilling steel of 50-65 Rockwell "C", operates at its highest efficiency at 350 rpm, while a ½ in. Raymac drill, drilling the same material, shows its best performance at 200 rpm.

Comprehensive information on how to point the new Raymac drills, or any technical data, is available from the company. Catalog #12 is available upon request.

T-10-851

NEW MEAD INDUSTRIAL
AIR POWER
CATALOG Ready!

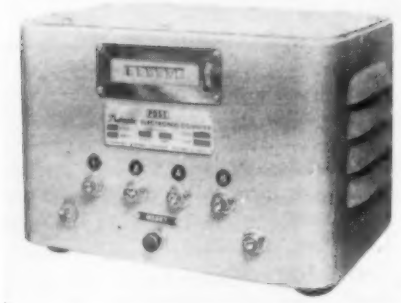
Full of Suggestions for FASTER, CHEAPER PRODUCTION!

Illustrates, describes Air Cylinders, Valves, air operated Presses, Vises, Chucks, Hammers, Drill Press Feeds, Work Feeders, Timers, semi-automatic combinations, etc.
*Pneumatic Cylinders

Write for Complete Catalog!

MEAD
SPECIALTIES COMPANY
4114 NO. KNOX AVE., DEPT. T-101, CHICAGO 41, ILL.
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-85

Counters



The Post Machinery Co., a subsidiary of Reid Bros. of Beverly, Mass., in collaboration with the General Control Co., Boston 34, Mass., have adapted their Counter for general-purpose counting in several variations.

Known as the Post Promatic Electronic Counters, they are said to be capable of counting in excess of 10,000 units per second, the operation of this new Counter may be either accumulative or pre-determined. The high-speed count, either of miniature parts, as well as large bulky units, is obtained through the use of photo-cell and electronic circuits. The Counter automatically energizes an external circuit for the purpose of segregating batches at the end of the predetermined count.

A visual six-digit totalizer indicates the exact count, while a rate meter shows at all times the rate of count per hour. The unit which may be located as far as 75 ft away from the photo-cell head, operates at 115 volts, 60 cycles, uses industrial type tubes and rugged components.

T-10-861

Profile Grinder

A standard machine for grinding the airfoil form on jet aircraft compressor blades is now available from Ex-Cell-O Corp., Detroit 32, Mich.

The machining cycle is automatic except for loading the work, pressing the start button and unloading the work at the end of the cycle. Blades are located from the finished root form (as ground on the Style 85 Ex-Cell-O Two Wheel Form Grinder) at one end and from a center in the other end. Accuracy of airfoil form is assured by the use of master cams made directly from the engineer's glass layouts. The coolant equipment also has automatic controls.

The Style 87 Precision Profile Grinder grinds the complete airfoil form including leading and trailing edges. As the work rotates it moves lengthwise across the grinding wheel at an adjustable rate of feed. Because the area of contact between the work and grinding wheel is very small at the leading and trailing edges and quite large at the broad sides of the blades, the work speed changes as the blade rotates. A two-speed work drive motor slows down while the grinding wheel cuts the broad sides of the blades, then speeds up while the narrow edges are being ground.

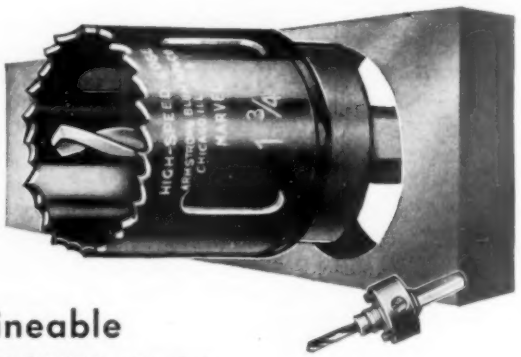
Ex-Cell-O Precision Grinding Spindles are available for any speed required and for any practical wheel size.

T-10-862

Cut...

LARGE HOLES

... thru any machineable material up to 1⅛ INCHES thick!



Here is a premium tool which makes it possible to saw holes in one short operation ... large holes which heretofore had to be laboriously machined "a-chip-at-a-time."

MARVEL High-Speed-Edge Hole Saws have strength to withstand the terrific peripheral strains of heavy duty operation in lathes, drill presses or portable power tools. They have a high speed steel cutting edge which is electrically welded to a tough, alloy steel body, high speed steel pilot drills, heavy hexagonal shanked arbors and sufficient set for deep drilling. They are self-aligning, as the larger diameter saws float on their arbors and are driven by double drive pins. They will saw round holes accurately in any machineable material.

MARVEL High Speed-Edge Hole Saws come in 35 sizes, from ⅜" to 4½". They are carried in stock by leading industrial distributors.

WRITE FOR BULLETIN ST-650

"MARVEL" *has Always had the edge!*

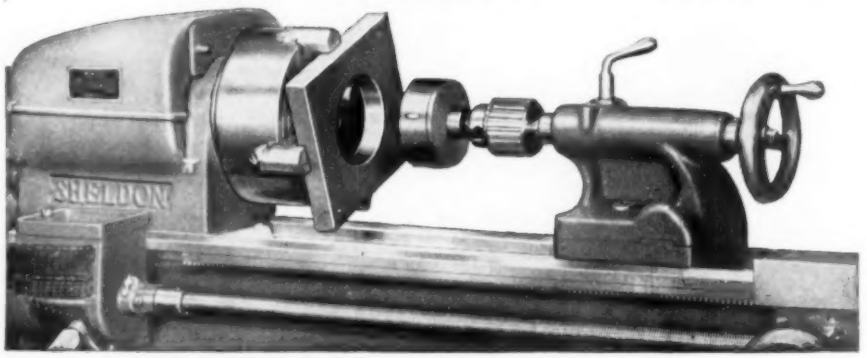
MARVEL Metal Cutting SAWS

Better Machines-Better Blades

ARMSTRONG-BLUM MFG. CO.

"The Hack Saw People"

5700 Bloomingdale Avenue Chicago 39, U. S. A.



FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-86

ydraulic Table by DoAll

While the table illustrated was primarily engineered as standard equipment on the Hp-36 Zephyr variable speed bandsawing machine, it is now available as an accessory table mountable on any standard DoAll machine.

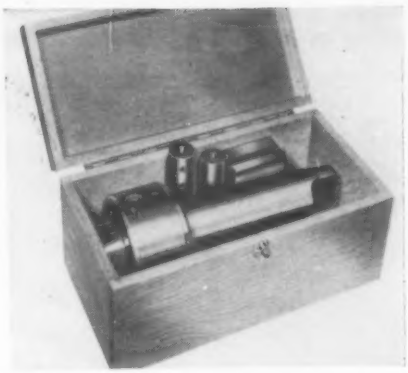
The table shown is used on a 60 in. throat 40 in. work height capacity DoAll band machine, Model V60. It has a 40 x 48 in. table and a carriage bed 87 x 36 in., said to support a load of 3000 lbs. The bed connects to the machine frame and is supported by fabricated steel legs with leveling screws. Floor space of the unit is 26 x 40-½ in., weight 3000 lbs. and the table surface is 45-¾ in. from the floor. The table has four T-slots to receive work-holding clamps or vises.

The hydraulic system consists of a 3 gal. reservoir with filler opening and clean-out plate, and a 2 gpm gear-type hydraulic pump driven by a ¾ hp motor. The circuit has an adjustable relief valve to limit working pressure to approximately 200 lbs. psi. Controls, governing rate of table feed up to 18 ipm and reversing rate of 36 fpm, are conveniently located on a panel mounted on the carriage bed. Complete information may be had from The DoAll Company, Des Plaines, Ill.

T-10-871

Boring Chuck

The Samson Offset Boring Chuck, now being manufactured by Last Word Sales Co., 18500 Mt. Elliott, Detroit 34, Mich., offers special features. The block operates in dovetail ways and the block, cover and body, all of which are machined from the solid and ground, are also lapped on contact areas for rigid fit of the block and precision setting. Fast and accurate setting of the tool hole at dead center is accomplished



through provision of a positive stop against which the tool block is retracted.

The micrometer offset screw offers adjustment to 0.001 in. and is also hardened, ground and lapped. Clearly indicated markings on screw and body facilitates hex wrench set-up.

The chuck is available with either threaded body or integral taper shank. When installed in a milling or boring machine, it is said to provide a tool holding device for cutting tool, set-up bar, etc., as accurate and rigid as the machine itself.

Interchangeable Boring Chuck Accessories, all of alloy steel, hardened and drawn, and ground to 0.0005 in. slip fit in the tool blocks, also are available.

T-10-872

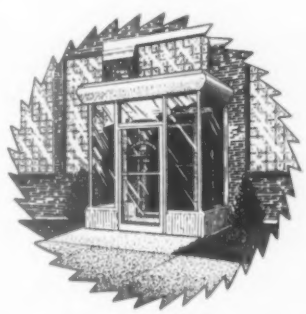
At CIRCLE ® Quality Makes Progress

Over the years Circle ® Metal Cutting Tools have established a quality reputation unexcelled anywhere! Circle ® is expanding its plant for the sole purpose of ensuring the maintenance of these high quality standards . . . a decision which will give you still higher quality and the most efficient and economical circular cutting tools available.

CIRCULAR TOOL CO., INC.

PROVIDENCE 5, RHODE ISLAND

Chicago • Cleveland • Dayton • Detroit
Burbank • Milwaukee • New York City
Indianapolis • Pittsburgh • Philadelphia
Phoenix • Providence • Rochester • St. Louis

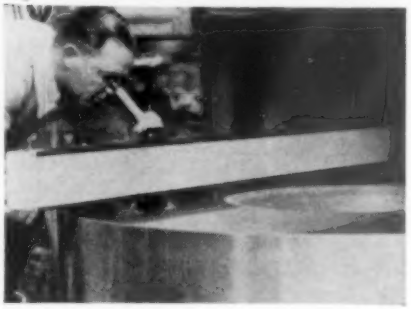


FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-87

Contour Measuring Device

Deviations of as small as plus or minus 0.00005 in. from a supposedly flat surface may be measured by utilizing a beam of light as a straight-line reference with the Griswold Huet Optical Straightedge. This contour measuring device consists of a lens and prism housing, and a feeler microscope with built-in illumination which rides along the surface under examination.

Made in standard lengths of approximately 3, 5, 10 and 13 ft, the housing rests on two blocks and the feeler, which includes the optical system, slides on the work surfaces. The errors,



observed through the microscope, indicated by the relative position of indices. The distance between indices is converted into linear measurement by reference to a micrometer thimble.

By accessories attached to the equipment, deviations, enlarged by 1000, are traced for permanent record on ordinate paper as the feeler is moved from one end of the housing to the other.

T-10-881

Electronic Micrometer

Rapid and accurate measurements to a tolerance of 0.00002 in. are claimed for the Electronic Micrometer, manufactured by J. W. Dice Co., Englewood, New Jersey. An electronic circuit used in conjunction with an extremely accurate micrometer head permits "pressureless" measurement and eliminates "feel" as a source of error. The electronic circuit is sufficiently sensitive to give a positive "on and off" indication with only five millionths of an inch displacement at the contact. Several models are available with different work capacities for measurement on compressible or non-compressible materials either conducting or non-conducting in nature. All models are portable, require no levelling and are unaffected by vibrations, variations in temperature, line voltage or aging of electronic tubes.

According to the maker the instrument can be used for rapid measurement of machined parts, ball bearings, small assemblies, depths of counterbore. It can also be used to measure deflections in diaphragms, bi-metal elements, springs, bellows and similar applications requiring measurement without pressure. It can also be applied to measure soft or compressible materials precisely such as paper, foil, ribbon, rubber, felt, plastic sheets, linoleum, photographic film and textiles.

T-10-882

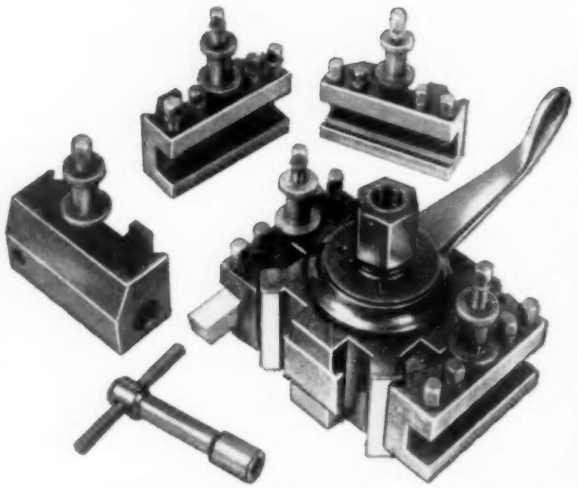
USE READER SERVICE CARD ON PAGE 115 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

NOW...for Ease, Speed and Complete Accuracy in Interchanging Multiple Tool Setups!

DIMCO

UNIVERSAL TOOL HOLDER

IMMEDIATE DELIVERY



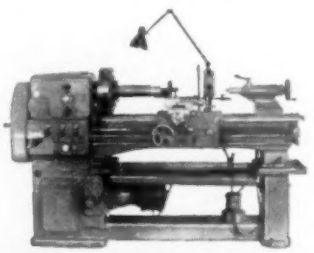
Here's the ruggedly built DIMCO Universal Tool Holder adaptable to fit any engine lathe in your shop for continuous production runs. . . . Reduces down-time drastically because of unusual flexibility resulting from its quick-change cam action.

The new DIMCO consists of a main center section which is fixed in position on the compound, and may be rotated 360° for a setup for *any* series of operations. Standard practice is to furnish a 5-tool setup for each tool post, consisting of a tool setup with a Morse taper hole for drill chuck or boring bar, a v-type setup for holding a round bar, and three setups for square or rectangular shape tools. All setups are permanent except for sharpening of tool bits and for compensation in wear of the tools. . . . *Protected by U.S. and foreign patents.*

Let us send you complete data on this precision unit. . . . The cost is surprisingly low, too. Write today!

• Kelvin also distributes DIMCO engine lathes from 11" to 24" swing, and DIMCO universal millers and geared shapers. Pictured at right is the new DIMCO precision geared head engine lathe DBC-175 with 13" swing, containing many new features . . . and priced *right!*

DIMCO machine tools are the products of an old-line Italian manufacturer highly regarded in Europe for many years. They take standard attachments. *Write for further information.*



KELVIN SYSTEMS CORPORATION
IMPORTERS OF MACHINE TOOLS

K KELVIN

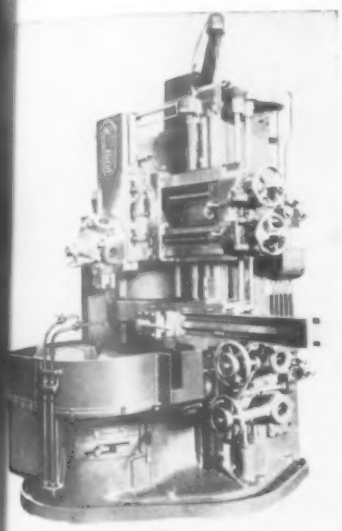
SHOWROOMS | 53 WATER STREET SOUTH NORWALK, CONN.

MAIN OFFICE: 135 FRONT ST., NEW YORK 5, N.Y.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-88

oring, Turning Mill

42-in. vertical boring and turning with side head is announced by win-Lima-Hamilton Corp., Hamil- Ohio. The "Niles Side Head Mill," been modernized by increased speeds and corresponding feed ges; by use of anti-friction bear- in the table speed change gear and table mounting; and by a er powered drive from a 30 hp or.



The machine is said to combine the vantages of turret lathe, engine lathe, d vertical boring and turning mill, th independent or simultaneous en- gement of down and cross feed or wer traverse for both rail head and de head. Centralized and simplified ntrols for multiple tooling make it daptable to job shop or quantity pro- uction.

Design includes integrally cast col- nn and base, which gives high rigid- y, a three-track cross-rail, assuring roper alignment between cross-rail nd table in all positions of the rail, nd an elevating screw adjacent to the arrow guide, which prevents tilting nd binding. Wear of all moving parts s easily compensated.

A center stop which accurately lo- ates the rail head and maintains per- ect alignment between it and the center ine of the table spindle is an important eature essential for accurate boring with double head cutters, for drilling nd reaming.

Actual swing with side head down is 50 in. Maximum distance from table op to turret face is 48 in. The vertical head, which has five faces, has a slide travel of 28 in. and will swivel 45 deg to either side of vertical position. The side head, which has four faces, has a vertical working travel of 35 in. and a horizontal travel of 21 in.

There are 12 table speeds ranging from 9 to 200 rpm and 16 feeds for either vertical or side head between 0.003 and 0.520 in. per revolution of the table. The machine occupies a floor space 8 ft 4 in. wide by 8 ft 10 in. deep and stands 10½ ft high.

Optional accessories include a 3-jaw combination clutch or plain table in place of 4-jaw independent chuck, a taper turning attachment for side head only, thread cutting attachment for either head, cutting fluid attachment, and fixtures and tooling. A profiling attachment can be applied readily at any time.

T-10-891

New Sizes Added

Morton Machine Works announces that in addition to their present line of Jig Feet and Rest Buttons they are adding five new sizes—all carburized, hardened and ground. These are being manufactured and carried in stock in order to provide the widest range of usefulness to tooling programs. Full size templates for tracing purposes are available, upon request, from Morton Machine Works, 2421 Wolcott, Ferndale 20, Mich., Dept. 23.

T-10-892

REED RID CO.

Cylindrical Dies
Thread Rollers

For Precision Threading
Knurling — Forming
Burnishing — Serrating

Superior strength is largely responsible for the increased use of rolled threads. The cold forging action of thread rolling produces a thread that is substantially stronger and tougher than similar threads produced by other processes. Improved fatigue strength of 50–75 per cent is commonly reported.

Increases Tensile and Shear Strength
Increases Resistance to Fatigue

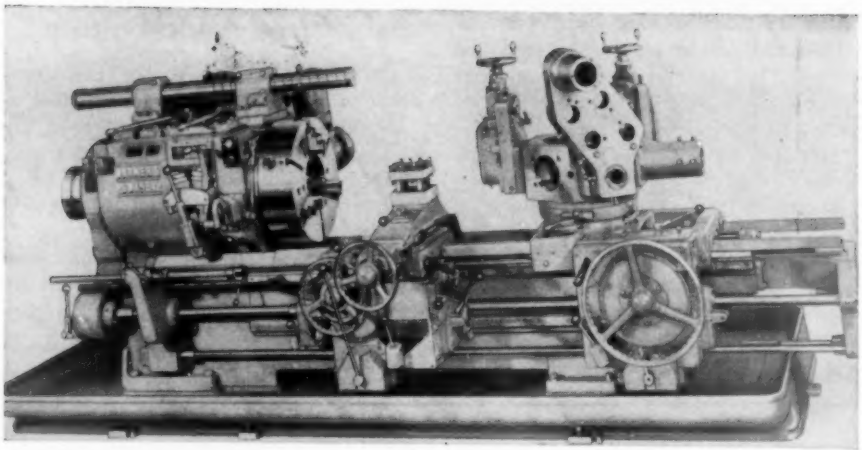
Send us specifications of your requirements and let us supply you with complete information.

REED ROLLED THREAD DIE CO.

Manufacturers of
THREAD ROLLING MACHINES and DIES • KNURLS • THREAD ROLLS
Worcester Massachusetts, U.S.A.

TE-020

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-89



Turret Lathes

A model 4A heavy duty saddle turret lathe featuring several de changes is announced by The Warn Swasey Co., 5701 Carnegie Ave., C land.

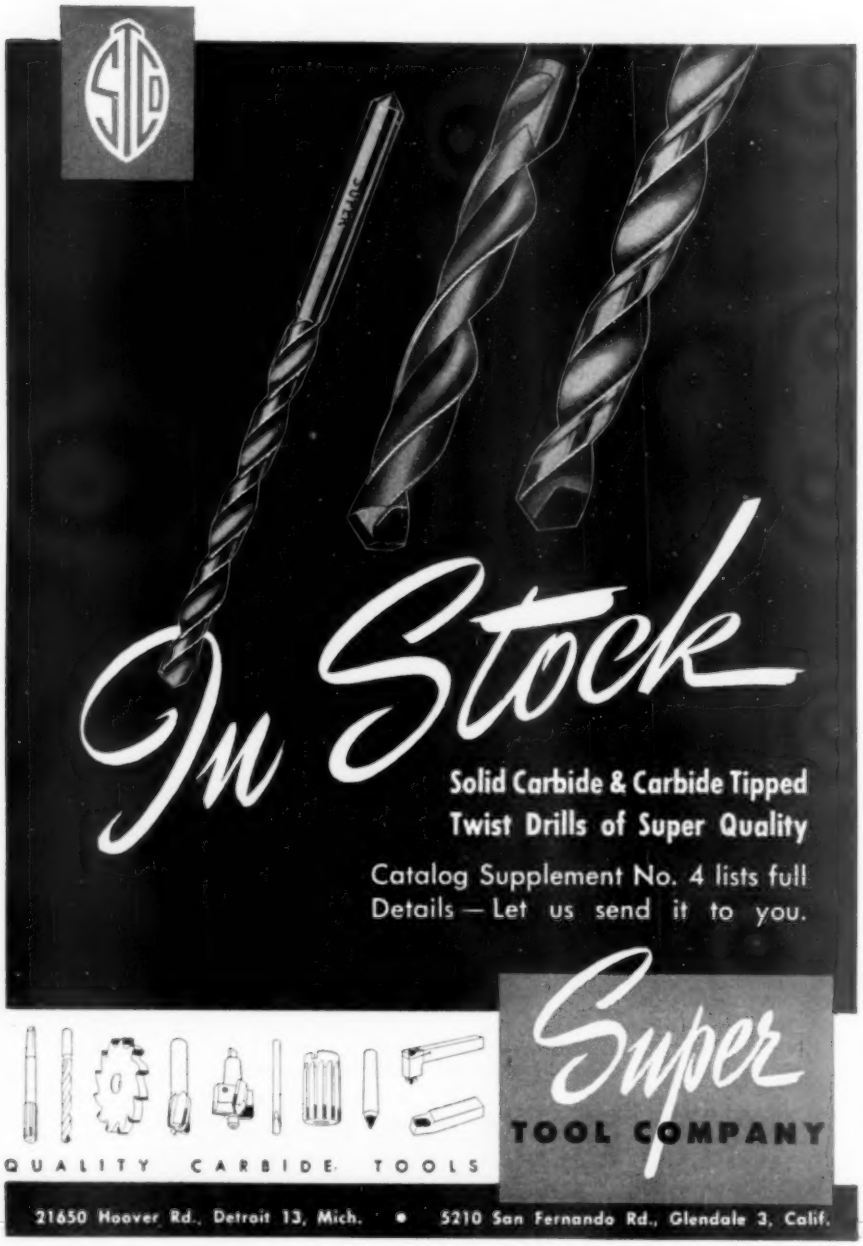
A hydraulically actuated forward reverse clutch in combination wi disc-type hydraulic brake has been corporated in the headstock, provi for faster, smoother, shockless dling of the 8 - 12 in. bars accom dated by this size machine. The cl and brake mechanism is controlled a "forward-reverse-brake" lever wh eliminates the neutral or intermed delay position previously used. starts, stops and reversals of hea weighted spindles are thus permitte

The rapid traverse shaft has b moved to the front of the machine, rapid traverse is now provided to cross slide, with a single lever to co trol rapid traverse motion in four rections.

Power for the rapid traverse dri formerly by belt take-off from the ma drive shaft, is now supplied by a sep rate 3 hp motor mounted in back the headstock. The same auxiliary m tor also drives the coolant, hydrau and lubricating pumps.

Pressure in the lubricating syste has been increased, and a new-ty high pressure gear pump has been a plied to the unit.

T-10-901

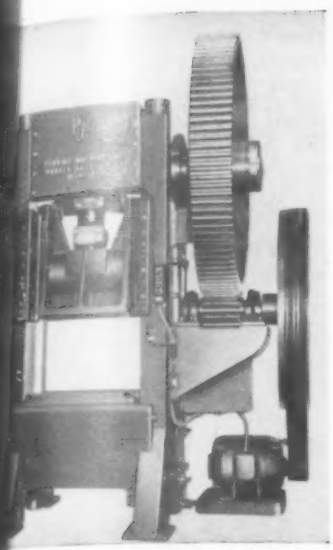

In Stock
Solid Carbide & Carbide Tipped
Twist Drills of Super Quality
Catalog Supplement No. 4 lists full
Details — Let us send it to you.
QUALITY CARBIDE TOOLS
Super
TOOL COMPANY
21650 Hoover Rd., Detroit 13, Mich. • 5210 San Fernando Rd., Glendale 3, Calif.

Small Bench Press

Peacock Metal Products, Inc., is introducing a solenoid-operated bench press called the Mighty Midget. The press is suitable for various operations, delivering a one-ton impact on a 110-volt line every 1/6 second if desired. The press is activated by a micro-switch located under the base, and the plunger will not repeat. The press can also be equipped with a foot switch and a variac control which regulates the amount of impact. For further information, write the company, Dept. T, 752 Hyde Park Ave., Hyde Park 36, Boston, Mass.

T-10-902

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-90



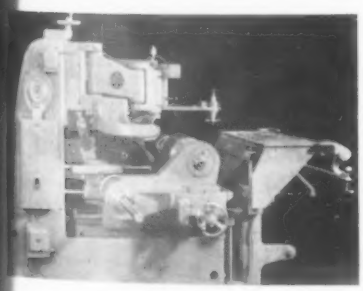
Straight Side Press

e Model 12-H-36 Straight Side le Crank Press recently announced Perkins Machine Co., Warren, s., is presented as an answer to the for a versatile press of this type. dily built and of rigid press con- ction throughout, this model, with capacity of 200 tons, meets today's irements for economical operation low upkeep. It has a bed area of x 36 in. with 8 in. diameter main ring and is designed for convenience operation and for easy accessibility changing dies. The large bed will commodate a wide variety of work.

T-10-911

oll Engraver

A completely new Pantograph Ma- ine has just been designed and built the George Gorton Machine Co., cine, Wisconsin, for accurate mill- routing and engraving completely ound cylinders and rolls.



One of the basic advantages of this achine in addition to its contribution economy is that modifications of arious machine components may be ade to meet a wide range of require- ents as to ratio of reduction, range nd roll diameter.

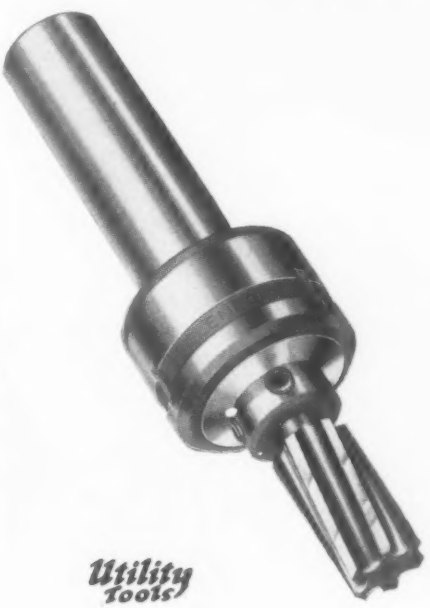
In operation this Pantographic Roll Engraver accommodates rolls (ferrous r non-ferrous metal and plastic) from in. to 12 in. in diameter and up to 40 in. long. The workpiece is held between centers as on a lathe. Movement of the tracer forward and back automatically rotates the roll. Longitudinal left-to-right movement of the tracer does not rotate the roll. Thus, the cutter point is always centered over the axis of the workpiece.

Maximum area covered by the cutter at one setting is 5 in. by 20 in. A master pattern is cut in flat brass, sheet iron, zinc or sheet plastic in either sunk or relief form and twice the desired size. Only a small segment or section is required of the entire design if it is to be repeated all around the roll. Then the master is clamped to the master table at the front of the machine ready for tracing.

This machine features a precision-built heavy duty spindle, belt-driven by a ½ hp variable speed d-c motor which provides variable spindle speeds of from 500 to 12,000 rpm. If required, this speed range can be changed to meet the specific needs of the buyer.

Net weight of entire machine is approximately 10,650 pounds and approximate floor area is 80 in. wide by 87 in. front to back. **T-10-912**

YOU be the ---JUDGE of Glenzer



Utility Tools

FLOATING TOOL HOLDERS

They automatically correct misalignment within 1/32" radius or 1/16" diameter — produce perfectly aligned work on new or old machines — save the time formerly needed for close adjustments and put old machines back to work.

Order any stock size — test it in your own plant — if it doesn't prove its value, return within 30 days and you won't owe us a cent. We want you to KNOW what Glenzer Floating Holders will do on your machines — then *YOU* BE THE JUDGE!

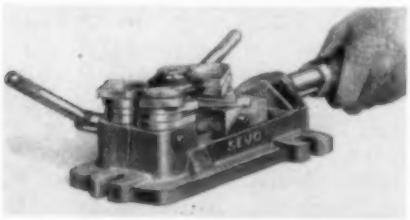
THE J. C. GLENZER CO. Inc.

1552 E. NINE MILE ROAD, DETROIT 20, MICH.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-91

New Vise Offered

An ingenious universal screw vise that instantly clamps round, tapered or irregular objects has just made its appearance on the market. A Swedish concern produces the product, called the "Sevo" vise. Its jaws consist of a series of machined and ground flat plates which hinge or swivel in any desired direction to coordinate with the shape of the held object. These jaws are so designed that they can be moved in relation to each other, and the workpiece can rest on a contact surface underneath. By turning the main screw the locking jaws position themselves and can then be locked to retain their directional position. Unlike conventional vises, the tightening screw requires only a slight turn, without imposing a heavy torque, to tightly grip the object.



The vise jaws are made of pre… ground Swedish steel. The distan… tween jaws is 2½ and 5 in. in two …

A bulletin giving details can b… tained by writing to De Wilde … 181 Steuart Street, San Francis… Calif. T-10-…

Broken Drill Remover

The Elox Electron Drill, the … Tapmaster, for the removal of bro… taps, drills, reamers and studs … guaranteed record speeds, has recen… been announced by the Elox Cor… ration of Michigan.

The M-7 Tapmaster employs … electrode—hollow copper alloy tub… available in various diameters—wh… is chucked into the "Disintegrati… Head" and held firmly by a collet. … removing a broken tap or drill, an el… trode about half the diameter of t… broken tool is used, and the he… lowered so the electrode is center… about ¼ in. above the tap. As the he… is fed downward, in the same manne… as a drill press, a series of electric a… cut down between the core and thread… of the tap without damage to t… threads.

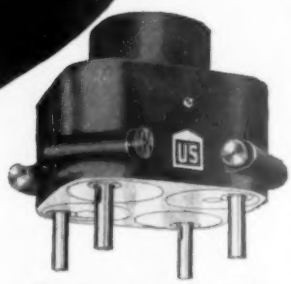
A coolant pumped through the ho… low electrode washes away particles … metal. In a through hole the core ca… be knocked out as soon as the electro… has cut its way through. In a blind ho… the core is picked out with a magnetize… pick or tweezers.

Rated at two kva, the Tapmaster … manufactured by the Elox Corporati… of Michigan, 740 N. Rochester Rd.… Clawson, Michigan. T-10-92

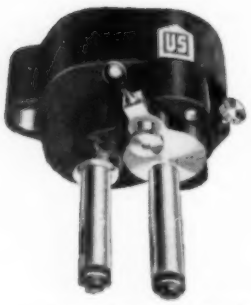
Hard to Please?

If you're looking for really fine quality heads, available at the lowest possible price, remember that our drill heads have been designed to answer fully today's drilling needs—and tomorrow's as well.

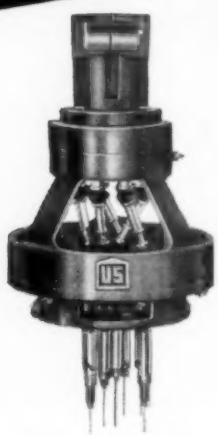
We manufacture all types of multiple spindle, fixed center, adjustable and individual lead screw tapping heads.



Single eccentric type for equally spaced holes on bolt circles.



Two spindle head unit —one spindle fixed, the other spindle adjustable for the fixed positions.



Universal joint with slip spindle fixed locating plate.

US HEADS

SINCE 1915

UNITED STATES DRILL HEAD CO.

CINCINNATI 4, OHIO

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-92

Inch Gear Shaver

evelopment in the field of gear g is a Red Ring Gear Shaving ne for both internal and ex- spur and helical gears with face up to 40 in. and pitch diameters 100 in., the first machine of its ever built. It is applicable to used in tanks, power shovels, hoists, large speed reducers, sta- prime movers and marine drive

aving is accomplished by the ap- d rotary crossed axes principle the work gear driving the cutter customary in shaving gears larger 24 in. PD.

e general design includes an in- ndently driven rotary work table a column which, moving horizon- , carries the cutter head to and s it into the work. The cutter head procates in its vertical slide across face of the work.

he work gear, with its axis vertical, lamped in a fixture mounted on a e rotary work table. There are no ecting machine elements above the e to interfere with handling heavy rs as they are loaded. Table speed elective over a wide range by means change gears.

The column, which carries on its for- d end the cutter head assembly, es horizontally and is supported ughout its full travel on hardened ground slide ways in the machine e. Approximate bearing pressure on se ways is 15 psi.

A direct reading dial indicator on column shows the operator the ex- amount of each increment of infeed also when the work has been ed to specified size.

The cutter head slide is mounted on gid tilting mechanism which can be curately adjusted to assure the path reciprocation being in exact parallel h the work gear axis. This mecha- m is also used when it is desired to er shave the work gear teeth. A dial icator shows the set-up man the ex- amount of taper in thousandths per of gear face width.

A central push-button station and selector switch is located on the side of the machine, while a duplicate set of controls in a pendant box is suspended from a swinging over-arm for the convenience of the operator in loading and in setting up.

T-10-931

35-Power Microscope

A universal mount permits the Edmund Microscope to swing freely in any direction, and facilitates examinations from any angle with far more working space for the viewer. Joint tension of the mount is fully adjustable. Prism erectors give the viewer an erect image, exactly as the eye sees it.

The Ramsden eye-piece provides fine precision focusing, and a three-element color-corrected objective is 1 in. in diameter. The microscope body is brass with black crackle finish. Working distance from objective to object is almost 3 in., which permits any work, dissection, tooling, etc., to be carried on "under power" while looking through the microscope.

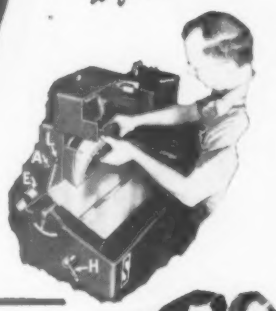
The instrument is 6½ in. long with a base 7 in. × 9 in.

Available from Edmund Scientific Corp., Dept. 88, Barrington, N. J.

T-10-932

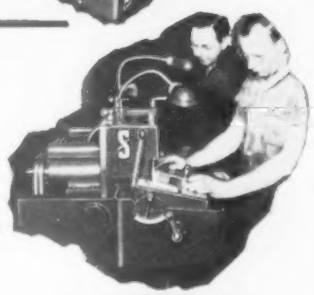
10" or 14"
TWIN WHEEL
WET OR DRY
TOOL GRINDER
FOR CARBIDE, STELLITE OR HIGH SPEED STEEL TOOLS

one step from rough to finish grind



(Right) Mounting a new wheel in 5 minutes!

(Right) Operating view of 10 TD shows ample room to comfortably serve two operators. (Twin lights are optional.) Complete operator comfort when grinding wet. Absolutely no spray or splash.



UNIVERSAL PRECISION PROTRACTOR — TOOL GUIDE with DRESSER grind any size tool for any desired angle.

WRITE FOR BULLETIN TW

THE STANDARD ELECTRICAL TOOL CO.
2499 RIVER ROAD
CINCINNATI 4, OHIO

ALSO:
GRINDERS—ALL KINDS! UP TO 100 H.P. BUFFERS—POLISHERS UP TO 60 H.P. ABRASIVE BELT MACHINERY. SPECIAL MACHINERY. TWIN WHEEL TOOL GRINDERS.

Visit Our Booth G-210, National Metal Exhibition, Detroit, Michigan—October 15-19, 1951

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-93

New J & L Die Head Line

Jones & Lamson guarantees Class III threads with this newly designed line—covering the complete B & S range from #0 to 1¼ maximum. The new J & L die sizes are also arranged so that a single given size die will cover the capacity of a given B & S machine size.

Features include: both radial and tangent chasers mounted on face of die for free coolant flow and good chip clearance; Dualife insert chasers for #00 machine dies, allowing turning over and using on the other side; two-thirds of this line, using tangent chasers, provides permanent throat feature; all have cushion springs for easy start; precision-lapped and fit chaser holding blocks; lever handle for use on small turret lathes; excellent strength-to-weight ratios; rapid chaser changeover—with less down time; standard chasers thread close to shoulder.

Write to Jones & Lamson Machine Co., Catalog Dept., Springfield, Vt., for further information. **T-10-941**

QUICK JOB CHANGES WITH

GREENLEE automatics

Injector plunger part machined on a 2-inch Greenlee Six from C-1117 bar stock in 59 seconds, to tolerances of 0.002". Former machining time was 3 to 4 minutes per piece on single-spindle equipment.

...INCREASE PROFITS FOR MITCHEL AND SCOTT

The quick change-over features of Greenlee Automatics . . . standardized, interchangeable tool holders, simplified cross-slide camming, rapid stroke-setting arrangement, built-in threading drive, and other important characteristics make them equally adaptable for short or long-run applications.

The Mitchel and Scott Machine Company, Inc., of Indianapolis, Indiana, operate seven Greenlees . . . using them in producing a wide variety of job-shop work. Some of the jobs, such as the one illustrated, run as few as 2000 pieces . . . so set-up time must be reduced substantially to make them show a satisfactory profit.

* If your production schedules are cramped by long, costly set-ups, we'll be glad to make recommendations.

PRODUCTION MACHINERY GREENLEE

GREENLEE BROS. & CO. 1990 MASON AVE. ROCKFORD, ILLINOIS

MULTIPLE-SPINDLE DRILLING, BORING, TAPPING MACHINES • AUTOMATIC SCREW MACHINES • AUTOMATIC TRANSFER PROCESSING MACHINES

Greenlee Bros. & Co., Detroit Office—504 Curtis Bldg., 2842 West Grand Blvd., Detroit 2, Mich.

CHARLES W. STONE COMPANY
1019 Marquette Avenue
Minneapolis 3, Minnesota

CINROCK MACHINERY, INC.
744 Broad Street
Newark 2, New Jersey

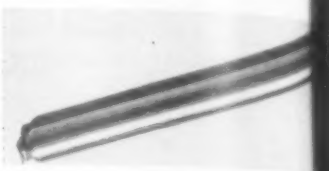
HEPWORTH MACHINE TOOL COMPANY
2311-17 North Sixteenth Street
Philadelphia 32, Pennsylvania

DAWSON MACHINERY COMPANY
5700-4 First Avenue, South
Seattle 8, Washington

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-94

Abrasive Wheel Dresser

A boron carbide tipped Abrasive Wheel Dresser consisting of an insert ¼ in. sq by ½ in. long set in an aluminum handle 5 in. long, is offered by Robert Marks Co., 47 Goddard Ave., Providence, R. I.



The insert is "norbide", Norton Company's molded boron carbide, a material that is claimed to be superior in hardness to tungsten carbide, aluminum oxide or silicon carbide. The dresser is designed specifically for the hand dressing of grinding wheels 1½ in diameter or less and of M grade hardness or softer. It is suggested as being especially useful in tool-room work and in forming wheels for thread and cutter grinding. T-10-

Budget Laboratory

Contractors engaged in work for the Armed Forces which requires inspection procedures to meet certain government specifications will be interested in a "limited budget laboratory" which has just been announced. The assortment contains measuring tools and instruments capable of performing all ordinary operations to measure and inspect thickness, length, diameters, forms of tools, templates and dies, pitch, lead and form of screw threads, visual inspection of finish, circular divisions and graduations, etc. The tools and instruments which may be purchased separately are: (1) Wilder Micro-projector; (2) binocular three-dimensional microscope; (3) toolmaker microscope for 1-in. × 1-in. coordinate measurement and thread checking with optical test plates; (4) Opti-Comparitol for measuring and inspecting precision parts; (5) illuminated magnifiers; (6) Cherman height gages; (7) Ultra-Check gage blocks; (8) assorted micrometer and snap gages, etc.

Further information on these items may be secured from Geo. Scherr Co., Inc., 200 Lafayette St., New York 12.

T-10-943

Grinding Machines

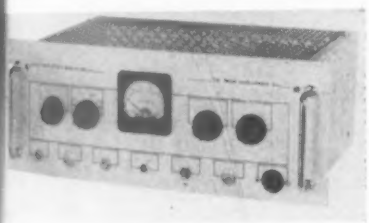
Several design changes in their 10 in. and 14-L Plain Hydraulic Grinding Machines have been announced by Cincinnati Grinders, Inc. in an effort to improve performance and increase operating convenience.

Headstock of these machines is now powered by a one hp a-c motor, eliminating the necessity of a d-c line to the machine; a magnetic brake is built-in; power is transmitted entirely through V-belts; an eccentric arrangement for the primary countershaft provides a way to adjust belt tension and change the belt on the four step pulley. The bed is 2 in. lower than before; now only 39½ in. from the floor line to the centers. Grinding wheel collets are designed for 12 in. hole wheels, for continued usefulness on smaller machines after the OD wears beyond the size for efficient grinding.

The Filmatic bearings, which have been retained for the grinding wheel spindle, are self-adjusting. Catalog No. G-603 gives complete engineering specifications and an outline of principal features for Cincinnati Grinders, Inc., Cincinnati 9, Ohio.

T-10-951

Rack-Mounted Amplifier



Available for delivery is a new Direct Coupled Amplifier, designed for use in standard 19 in. rack and having a 7 in. high front panel. Designated as Model BL-962 by the maker, Brush Development Company, the instrument was designed for use with Brush Magnetic Direct Writing Oscillographs in studies of such static or dynamic conditions as strains, displacements, pressures, light intensities, temperatures and a-c or d-c voltages or currents.

Voltage gain of the instrument, approximately 1000 times, is sufficient to give one millimeter of deflection on the oscillograph chart per millivolt input. Zero signal drift amounts to not more than one chart millimeter per hour. When the amplifier is used with the penmotor, the frequency response is essentially linear to 100 cycles per second.

A detailed description of this amplifier may be obtained from The Brush Development Co., Instrument Division 51, 3405 Perkins Ave., Cleveland 14, Ohio.

T-10-952

Never before A TAPPING MACHINE WITH ALL THESE ADVANTAGES

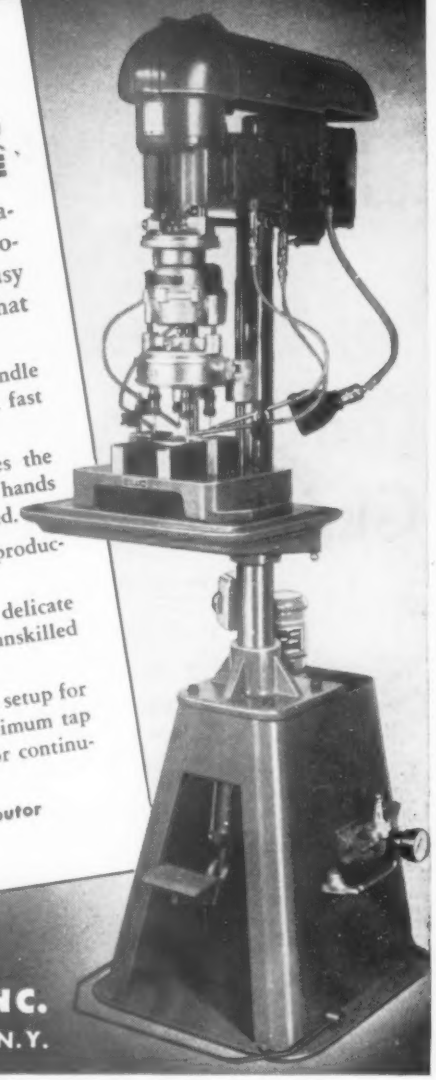
Ettco-Emrick

FOOT OR AIR OPERATED 72A TAPPING MACHINE

Here is a fast, versatile foot or air operated tapping machine that puts high production precision tapping within easy reach of all manufacturers. Here's what it offers —

- **VERSATILITY.** Interchangeable single spindle tapping units and multiple heads permit fast changeovers from job to job.
- **HIGH SPEED.** Foot or air pressure does the work with a minimum of effort. Both hands are free to handle the part being tapped.
- **ECONOMY.** Low initial cost and high production rates add up to big savings.
- **BUILT-IN SENSITIVITY.** No skill or delicate touch is needed — it's ideal for unskilled operators.
- **ADAPTABILITY.** There's a lubrication setup for any tapping — gravity feed for minimum tap lubrication — a pumped oil bath for continuous flow.

For details, ask your distributor for Bulletin #72A.

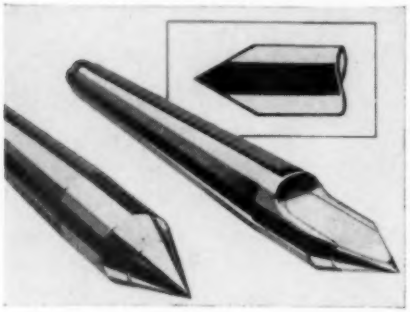


ETTCO TOOL CO., INC.
594 Johnson Ave. · Brooklyn 6, N.Y.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-95

Alloy Centers

Wear and abrasion-resistant centers, said to outlast high-speed and other alloy centers three to ten times before re-dressing becomes necessary, are available from Gorham Tool Co., 14400 Woodrow Wilson Ave., Detroit 3, Mich.



"M-40-U", a wear and abrasion-resistant material developed by Gorham, forms a core that is induction brazed into the steel shank of the center, after which the entire center is finish ground. Thus, the wear material is always supported by the tough shank steel throughout the life of the center. According to the manufacturer, these centers require only a cleanup grind when wear finally occurs, and hundreds of cleanup grinds can be made without loss of wear-resistant properties, since the "M-40-U" alloy is actually a deep core, rather than a clad or applied tip.

"M-40-U" centers and half-centers are available with Morse, Jarno or Brown and Sharpe taper shanks, in lengths from 3⅝ in. through 12¾ in. Folder No. B-76, gives descriptions, dimensions and prices.

T-10-961

Sander and Grinder

A Kindt-Collins Master Spindle Sander and Grinder for wood, metal and plastics, incorporating several new and exclusive features, has been announced by the manufacturer.

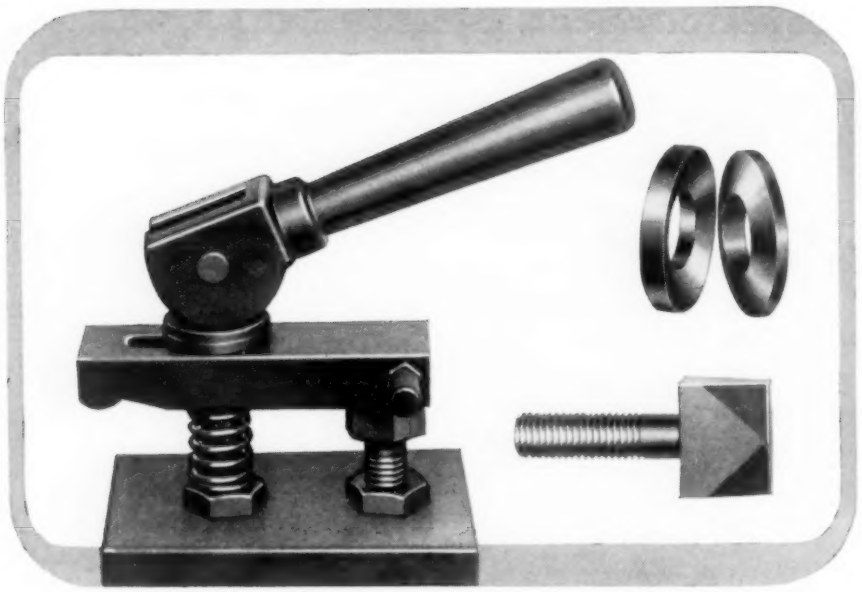
This is the only spindle sander and grinder of its type that has a tilting spindle rather than a tilting table, according to the maker. The job on which the operator works is always in a horizontal position. The Master Spindle can be used oscillating or non-oscillating, can be tilted from 0 deg to 45 deg by a worm and gear unit, and can be securely locked in place at any desired position.

Another exclusive Master feature is the core box attachment, which produces straight and tapered core boxes mechanically, eliminating tedious handwork and materially reducing the time involved.

Other Master features include a lighted periscope for easy reading of extremely accurate settings; a 2-hp constant hp motor, with choice of 2000 and 4000 rpm speeds; adaptability of abrasive sleeves from ¼ in. to 4 in. in diameter, and 6 in. to 11 in. in length; also grinding wheels up to 5 in. in diameter and 5 in. high. A built-in safety device prevents use of the high-speed with the large diameter units.

Full details of the Master Spindle Sander and Grinder can be secured from the Kindt-Collins Co., 12653 Elmwood Ave., Cleveland 11, Ohio.

T-10-962



Looking for Good Quality
CLAMPS and DETAILS?

Available at Your Nearest Distributor

Ramsdell Industrial Supply Co.
66 Southbridge St. WORCESTER 3, MASS.

Robert E. Morris Co.
238 Main St. CAMBRIDGE 42, MASS.
967 Farmington Ave. WEST HARTFORD 7, CONN.

Buffalo Rubber & Supply Co.
37 Carroll St. BUFFALO 5, N. Y.

Larrabee Associates, Inc.
103-14 Roosevelt Ave. CORONA, N. Y.

Catalog and Tracing Templates, on request.

LODDING, Inc.
WORCESTER, MASS.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-96

Precision Honing Unit

To generate accuracy and hold precise tolerances in bores that are short in proportion to their diameter, the Micromatic Hone Corp., 8100 Schoolcraft Ave., Detroit 4, Mich., has developed a new type honing unit.

The unit is simple and compact. One motor, mounted on the spindle housing, powers both the rotation and reciprocation motions. It has a mechanical stroke adjustable and positive up to two in. in length. The self-contained unit is supported by two vertical bars. The adjusting head is designed into the spindle housing with the expansion indicator dial at eye level. The expansion may be regulated manually or with the hydraulically controlled Microdial.

For rigidity and maintenance of alignment the fixture is carried by a saddle, supported by the same bars as the head. The saddle has a six in. fallaway from the honing position to the loading position. This rigidity makes it possible to hold squareness between the bore and the face of the part.

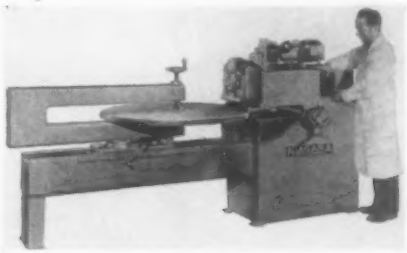
In single unit machines no hydraulic pumps are used. The fixture saddle is raised by an air cylinder and the Microdial is powered by an air-operated intensifying converter.

T-10-971

Circle Shear and Flanger

The Niagara Machine & Tool Works of Buffalo, New York has announced a high-speed Circle Shear and Flanger, especially designed for high production of disks and heads at a minimum tool investment. It is of interest particularly to manufacturers of tanks, drums, boilers, hot water heaters, containers, metal furniture and many other sheet metal products.

This machine will shear and flange a wide range of diameters and thick-



nesses of material. No blanking, forming or drawing dies for the many different size heads are required.

As a Circle Shear it cuts at high-speed circular disks or circular arcs of sheet metal of up to 8-gage mild steel or 12-gage stainless steel. Disks from 8 in. in diameter to 58 in. in diameter are produced from square blanks. Disks as large as 75½ in. in diameter can be cut from octagonal blanks.

As a Flanger it turns at high-speed smooth, high flanges up to 1½ in. deep from circular disks. The upper roll is moved down by power with speed adjustable to suit diameter and thickness of blank.

Write to Niagara Machine & Tool Works, Buffalo 11, N. Y., for Bulletin 86.

T-10-972

Hammond OF KALAMAZOO

GOOD MACHINERY SINCE '82

FAST ACCURATE GRINDING

of SOLID CARBIDE INSERT TOOLS

FOR ROUNDS, SQUARES, TRIANGULARS and RECTANGULARS

MODEL VC, Style M Motorized Solid Carbide Insert Grinding Fixture. Style H, without motor also available. Write for Bulletin No. 701.

HAMMOND MODEL CB-77 CHIP BREAKER AND DIAMOND FINISHING GRINDER can be supplied with both the standard Any Angle Vise and the Model VC Solid Carbide Insert Grinding Fixture.

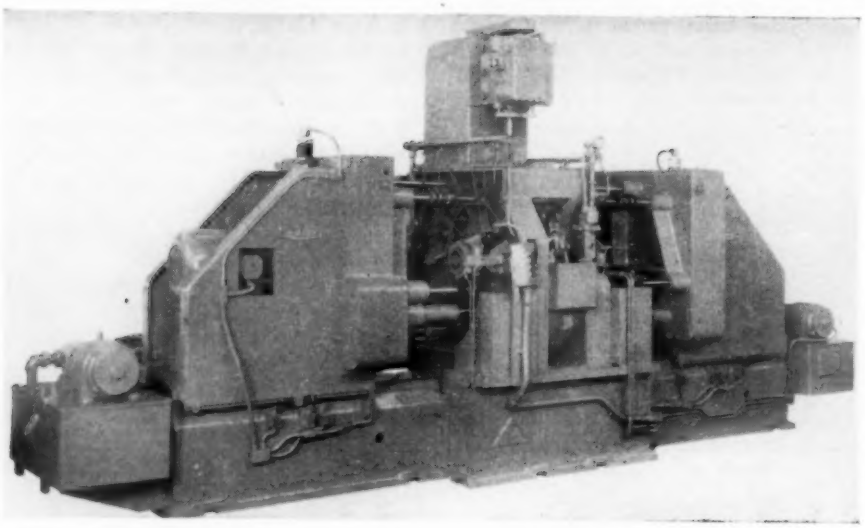
THE Hammond Solid Carbide Insert Grinding Fixture pays for itself in a few weeks. Offers a fast, economical and accurate means of grinding chip breaker grooves in round, square, triangular and rectangular shapes and for rough and finish grinding of dull and damaged carbide inserts. Motorized Style M with lug base can be mounted on most tool and surface grinders and Hammond C-4, CB-76 and CB-77 Chip Breaker Grinders.

BUILDERS OF AMERICA'S MOST COMPLETE LINE OF CARBIDE TOOL GRINDERS

Hammond Machinery Builders INC.

1600 DOUGLAS AVENUE • KALAMAZOO 54, MICHIGAN

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-97



Drilling Machine

A three-way 20-spindle Hydraulic Feed Drilling Machine is now being built by LeMaire Tool & Manufacturing Co., 2657 S. Telegraph Rd., Dearborn, Mich.

The machine consists of a fabricated steel center base which carries trunnion support with #200 twin ram vertical single spindle unit, with #30 BS horizontal right hand and left hand units. The right hand unit has a 9-spindle head and the left hand unit has a 10-spindle head. The #30 BS units have hardened and ground steel ways with a distance of 30 in. across the ways. The 10-position trunnion is hydraulically operated for automatic indexing and carries work holding fixtures which are clamped and unclamped with a hydraulic torque wrench.

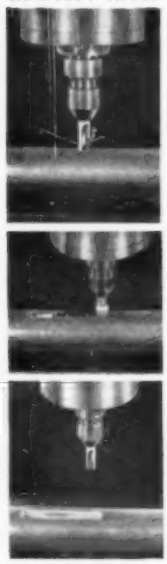
Production capacity is said to be approximately 100 pieces per hour at 100 percent efficiency.

T-10-981

NELCO *Carboloy-Tipped* 3 FLUTE END MILL

did this job *in 1/6th the Time*

***New* NELCO 3 FLUTE CARBOLOY-TIPPED END MILL:**



- Plunges into solid metal and mills. Will bore hole and mill in one operation.
- Eliminates Chatter—providing smoother cutting—a better job in astonishingly reduced time.
- Mills so smoothly that a finished cut is either not required at all, or to a much lesser degree.
- Stays sharp much longer—doesn't require resharpening as often.
- Provides Cooler and Freer Milling—More CHIP room decreases the chance of work overheating and twisting.

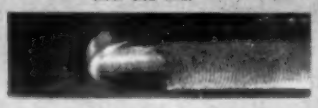
This tool is manufactured for use on all types of alloy steel, cast iron, brass and bronze. Sizes ranging from ⅛" to 2" diameter.

and did it *Better!*

One of the objective tests used by Nelco Engineers was the cutting of a "keyway". (Results illustrated below) End Mills compared were high-speed steel and Nelco's new Carboloy-tipped 3 FLUTE. Material was S.A.E. 1095 steel shafting. End Mills were ½" diameter; a 3 H.P. milling machine was used in both cases: 2400 R.P.M. and 14" per minute feed was used for the Carboloy; 609 R.P.M. and 3" per minute feed for the high-speed steel.

OPERATIONAL RESULTS:

2 MINUTES — To complete the job using high-speed steel end mill.



NOW COMPARE NELCO RESULT!

30 SECONDS — Job completed using Nelco's new Carboloy-tipped 3 Flute End Mill!

NOTE: ABOVE TEST PHOTOS UNRETOUCHED

SAVE hundreds of valuable production hours by giving the Nelco Field Engineer a few minutes of your time! Let him show you how Nelco Carbide-tipped Milling Cutters, End Mills and Twist Drills are lowering production costs for others.

Write for address of your Nelco Field Engineer

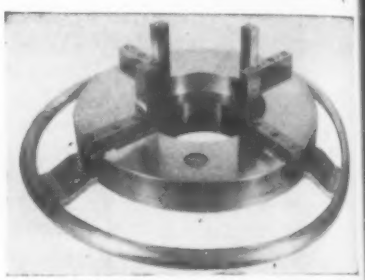
NELCO TOOLS

For that extra edge in production

NELCO TOOL CO., INC., Manchester, Conn.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-98

Chuck for Glass Working



A specially designed Chuck for use on Glass Working Lathes in connection with the manufacture of television tubes has recently been developed by the Westcott Chuck Co., Oneida, N. Y. It can also be used for other work that is handled on a glass working lathe. The chucks are built to fit a certain specification; for example, 3-jaw chucks for round bulbs, 4-jaw chucks for rectangular bulbs. Also they are designed for the several seal operations common to TV tubes.

Among important features is its thin body construction which results in a comparatively light weight chuck in relation to its diameter and holding capacity. This means minimum weight on the lathe spindle.

A large center hole is possible, which often is a principal feature for work handled on glass working lathes.

The design of the outrigger type jaws is such that a 16 in. chuck, for example, can be made to hold a 20 in. diameter round bulb in the 3-jaw chuck or a 20 in. rectangular bulb in the 4-jaw type. A 22 in. diameter chuck has been designed with outrigger type jaws to hold a 20 x 27 in. TV bulb.

T-10-982

Injection Molder

injection molding machine of 8 apacity said to combine the high of a small machine with the rigid ing of a larger is announced by er-Phoenix, Inc., Cleveland, Ohio. d the L-2-8, this machine retains 350-ton locking pressure, large die —22⅛ x 28 in.—and central die stment of the previous "8". It can mmodate the standard 18 x 23½ E mold base.

Plasticising capacity has been conerably increased, and hydraulic lines e been simplified and relocated out- the base for easier maintenance. e machine is designed to mold 8 oz. polystyrene material or 10 oz. of etate with effective plunger displacement of 32 cu. in. With its four pyrometers set at 600 deg F the machine is d to deliver hourly 80 lbs. of polystyrene heated to 400 deg F. Injection ssure remains unchanged at 200 psi.

T-10-991

Carbide Gage Blocks

Pratt & Whitney is prepared to furish Solid Carbide Precision Gage Blocks, in addition to its line of Steel Precision Gage Blocks—both USA and Hoke. Solid Carbide Blocks are furished in all sizes, 0.050 in. up to and cluding 4.000 in. They are sold (1) sets, (2) individually to replace orn steel blocks, and (3) as wear blocks in sizes of 0.050 in. and 0.100 in.

P & W Carbide USA Rectangular Blocks are manufactured to the same degree of accuracy as Steel USA Rectangular Blocks. Carbide Hoke Blocks, shown here, which are square design like their steel forerunners, permit the use of internal tie rods by which rapid, compact assembling of the various attachments is made possible without the use of outside clamps.

One-inch blocks and smaller are accurate to a tolerance of + 0.000004 and — 0.000002 of an inch, and sizes over 1 in. are accurate to the same tolerance per in. of length.

P & W Carbide Precision Gage Blocks are made from a premium grade of carbide. The measuring surfaces of each block are precision-lapped at 68 deg F. These Carbide Gage Blocks have excellent wringing qualities and are rust and corrosion resistant.

For informative Circular No. 532, write Pratt & Whitney, Div. Niles-Bement-Pond Co., West Hartford 1, Conn.

T-10-992

Minimize machining
reduce waste with
MILNE'S
Kolorkote
HOLLOW DIE STEELS
• For any given finished sizes, MILNE Hollow Die Steel weighs 13 to 20% less than corresponding ring forgings.
• Stocked in 3 grades.
• Sizes from 16" OD x 12" ID to 2" OD x 1" ID.
• Prompt deliveries from warehouse stocks.
• Cut to any length.
• Free from decarb . . . Rough turned OD x ID and saw cut faces.
• Every bar furnace-annealed . . . no scale.
• Write for catalog.
WATER HARDENING
OIL HARDENING
HI-CARBON
HI-CHROME
AIR HARDENING
★ Full length spray-painted with permanently identifying color.
★ Heat treat card of matching color with each shipment.
Plan To Visit Us At
BOOTH A-356
National Metal Show
Detroit, Michigan
October 15th-19th
DETROIT SALES AGENTS
SEVAERG METALS
915 Fisher Building, Detroit, Michigan
Tel: TRinity 3-1730
Warehouse Stock
A. MILNE & CO.
Chicago & Cleveland
A. MILNE & CO.
745 WASHINGTON ST., NEW YORK 14, N.Y.
America's Leading Tool Steel Specialists
Complete Line Of Tool Steels—Hollow and Solid
AM-6

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-99

Cleaning Bath

A pre-heat Chemical Bath, now on the market, is said to completely remove furnace scale which forms on steel during forging after heat treating. The product, now being marketed by the Pennsylvania Salt Mfg. Co., was developed from a practice originated at the Toledo, Ohio, and Pottstown, Pa., plants of the Spicer Mfg. Div. of the Dana Corp.

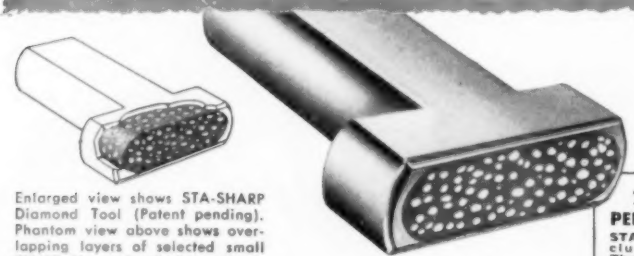
Savings of 90 percent over previous methods used in industrial production are claimed for the bath, which is made up of a product known as Pennsalt SR-4, dissolved in weak muriatic acid and water. The salt requires no heating and is made up in ordinary rubber lined tanks. Parts covered with forging scale are immersed in the bath for five minutes and then may be placed directly into heat treating furnaces or may be stored for later heat treating.

According to the producer, both laboratory tests and plant operations have shown that the SR-4 bath provides for scale removal from carbon steel forgings, even from deep indentations and blind holes difficult to reach in sand- or shot-blasting. The bath provides for efficient scale removal after heat t ment in most cases where oil quen are used, and in such cases where s removal is not complete, sand- or s blasting operations can be reduced.

A product bulletin describing product's properties and use is avail from Pennsalt Chemicals, Market search Div., 1000 Widener Bldg., Ph delphia 7.

T-10-1001

Inexperienced Operators Can't Abuse These Diamond Tools!



Enlarged view shows STA-SHARP Diamond Tool (Patent pending). Phantom view above shows overlapping layers of selected small SOLID diamonds which are firmly locked in place in a special matrix by exclusive bonding process.

70 DIAMONDS PER SQUARE INCH!

STA-SHARP tools are NOT cluster diamond tools. They are made with many overlapping layers of fine quality, natural small diamonds. The cutting face of each STA-SHARP presents not less than 70 solid diamonds per square inch.

New STA-SHARP Diamond Tools

Save up to 50% on your Diamond Costs

STA-SHARP tools are abuse-proof! Even the most inexperienced operator can't wreck these diamond tools by carelessness or incorrect use. The diamonds in these tools do not get dull. These must not be turned, require no supervision. They always do a good trueing and dressing job until *completely* used.

With the exclusive STA-SHARP design, as the top layer of diamonds wears down, the next overlapping layer comes into cutting position. While passing across the face of the wheel, as the forward diamonds wear down, the following diamonds maintain gage and give a true concentric and parallel wheel. This eliminates fading. STA-SHARP tools are not reset because they stay sharp to the very end.

Leading companies who have changed to STA-SHARP for their Centerless Grinders report savings up to 50% on their diamond costs.

Send for Circular

Mail coupon for special circular giving full details and prices on STA-SHARP Diamond Tools — also Catalog of complete line of Golconda Diamond Tools for every purpose.

GOLCONDA CORPORATION
(A Division of Super-Cut, Inc.)
3222 North Knox Ave.
Chicago 41, Illinois

Gentlemen: Please send me special circular of STA-SHARP diamond tools and complete catalog of Golconda Diamond Tools.

Name_____

Address_____

City_____ Zone____ State_____

Firm Name_____

Golconda Corporation
(Division of Super-Cut, Inc.)
3222 North Knox Avenue
Chicago 41, Illinois

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-100

Tapping Machine

The Ettco Tool Co., Inc., Brooklyn N. Y., announces the development of High-Speed-Sensitive Tapping Machi that can be operated by using foot air pressure. The machine, which re quires no particular skill to operate, built for the use of either single spindl tapping units or multiple heads wit provision for quick changeover fro one production job to another.

Tapping action is controlled through an adjustable pull spring inside the centerless ground column. Whenever the treadle is pressed down, this spring feeds the tap into the work and gives automatic protection against tap breakage or faulty threads.

Two oil tanks are built in the machine; one cast in head using gravity feed for light lubrication, the other in base for use with oil pump when steady flow of oil is required.

Built-in stripper plate permits the use of simple work holders and is used to strip part from tap. It also holds lubrication tube and brush. Bulletin #72A contains full details.

T-10-1002

USE READER SERVICE CARD ON PAGE 115 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Milling Cutter

A solid carbide indexable blade face milling cutter has been added to the Detroit Milling Cutter Co's. line of Futurmil face milling cutters, designed for milling cast armor plate and other difficult steel machining jobs.

This cutter retains the Futurmil principle of multiple production runs without cutter grinding, the solid carbide blades, when dull, merely being indexed to a new cutting edge, since the clearance angles are taken care of by the position of the blade in the cutter body rather than being ground onto the blade.

The blade is square and is furnished in three optional sizes ranging from ½ in. to ¾ in. depending on the depth of cut desired.

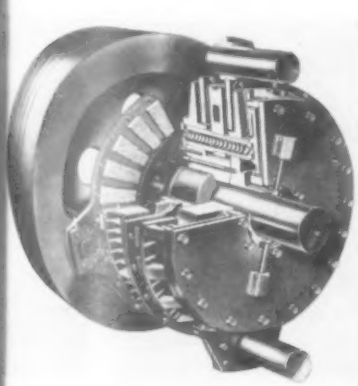
The blades can be indexed or substituted without removing the cutter from the milling machine spindle, a feature of importance where cutter grinding facilities are inadequate or machining difficulties cause any type of cutter to dull quickly.

The blade can be indexed eight times before regrinding, which is then done on a gang set-up on a surface grinder.

T-10-1011

Air Friction Clutch

After three years in development, an air friction clutch known as Type K, designed for 24-hour operation at high-speed, has been unveiled by E. W. Bliss Co., Canton, Ohio. Reports on a number of test installations indicate trouble-free operation.



Designed for fast action, positive clutch and brake engagement is achieved through an arrangement of driving discs in which movement between full engagement and braking is only a fraction of an inch.

Adequate self-induced ventilation assures rapid heat dissipation. The friction plates themselves are arranged to assist centrifugal blower action directed on the surfaces where the heat is generated. Cycle-welding of linings to plates encourages rapid heat transfer, while cycle-welded bond holds firm at temperatures well above maximum operating temperature of clutch.

Plates are arranged to compensate for wear automatically. Difference in plate travel with new friction plates and travel with worn out plates is less than a half-inch. Engagement is instantaneous in either case. Clutch and brake friction discs "float" in their mountings and align themselves automatically, preventing wear on the friction surfaces caused by lateral motion.

T-10-1012

WESSON METAL IS PRODUCING

MANY MORE "CONTROLLED" LOTS OF WESSONMETAL

TO MEET THE EVER INCREASING DEMAND FOR THIS IMPROVED CARBIDE!

WESSONMETAL

★ Solid Carbide Blades
★ Standard and Special Carbide Tips
★ Solid Carbide Shapes

6 STANDARD GRADES . . . 2 SPECIAL GRADES TO MEET HIGH SPEED AND HIGH FEED RATES OF MODERN MACHINE TOOLS

Uniform dependability is maintained in Wessonmetal because it is quality controlled by Wesson's exclusive method of small lot production. Each lot is carefully processed—rigidly inspected to maintain uniformity—highest possible quality. Whatever your needs in Solid Carbide—you can depend on Wessonmetal for Quality, Economy and Efficiency.

Write for Bulletin

WESSON METAL CORPORATION
Lexington, Kentucky
Affiliated with WESSON COMPANY

PIONEERS IN THE ART OF DESIGNING AND PRODUCING CARBIDE TOOLS

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-101

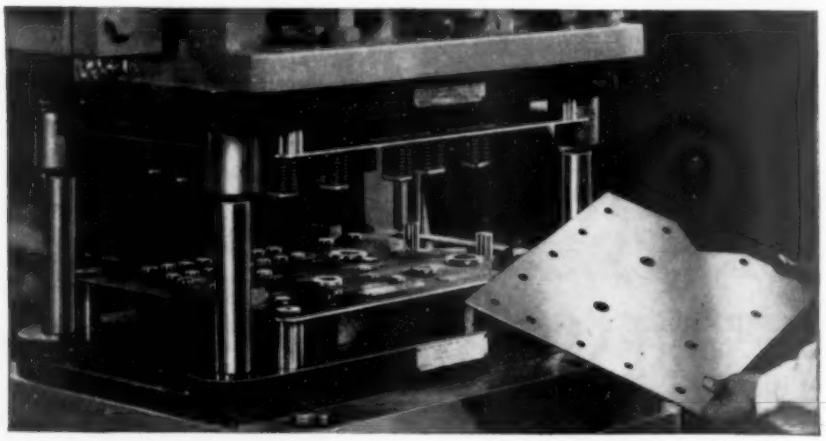
New • Fast • Proven

LOW COST

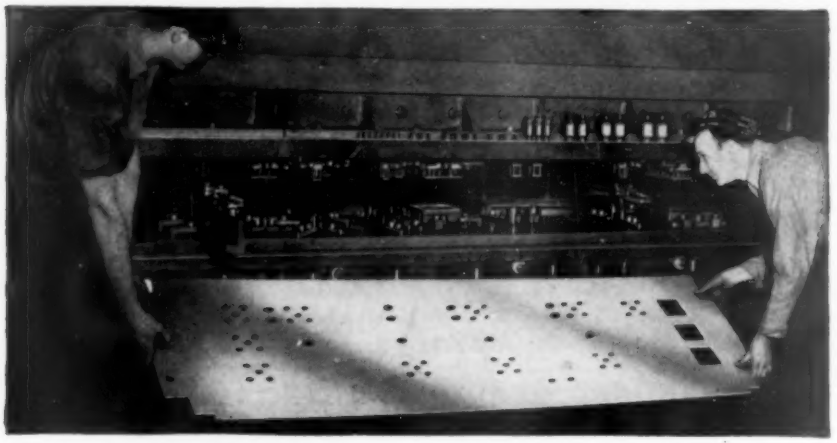
methods for PERFORATING and NOTCHING SHEET METALS

Both methods feature: LOW DIE COSTS

All units and parts are interchangeable and used repeatedly in different arrangements. **INCREASE PRESS PRODUCTION** – Down time is minutes as compared to hours for changeover. For precision work in all types and sizes of presses. **START PRODUCTION *at once.*** Pierce up to ¼" thick mild steel. Saving money in the best known plants.



Whistler *MAGNETIC* Dies at work in large inclinable press. Magnetized units hold the retainers. No bolting required. A fast, economical method in making up a punch and die set for short or long runs. All parts re-usable.



Whistler *ADJUSTABLE* Dies on ⅛" steel perforating and notching job, using Tee slotted die set. With Whistler Adjustable Punch and Die units production starts within hours instead of weeks. Last minute job changes made quickly.

Here are the complete details with prices and application illustrations. Send for these catalogs. No obligation.

NAME

FIRM

ADDRESS

CITY ZONE STATE

S. B. WHISTLER & SONS, Inc.

Adjustable, Magnetic, Custom and Cam Dies for all Industry

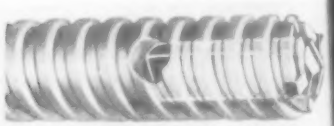
758 Military Road, Buffalo 23, N. Y.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-102

Nibbling Machine

Announced by Arduini Mfg. Co., 435 Shrewsbury St., Worcester 4, Mass., is a nibbling machine— the "Worcester"—designed for straight, contour or circular cutting. The tool is available in two sizes; one to handle up to ¼ in., the other up to 5/16 in. thick carbon steel.

Incorporating the basic design features of the German-made "Pels" nibbler, the "Worcester" has a 2-speed drive with variable stroke adjustment to accommodate different thickness of metal. Cutting speed is 1200 strokes per minute. T-10-102



Masonry Drill Bit

Cyclo-Core carbide tipped Masonry Drill Bit with removable Cyclo-Center recently announced by New England Carbide Tool Co., Cambridge 39, Mass., is designed for precision drilling in concrete, glazed tile or other hard masonry materials using a rotary type drill with pressure applied, for holes ¾ in. diameter and up. According to claim, removable Cyclo-Center does away with the necessity of using a wood template to start holes, since when inserted, it accurately locates and starts a hole.

As soon as hole is spotted; Cyclo-Center is removed. The accessory also does away with walking of the bit or marring of the surface being drilled.

Dust is expelled by Cyclo-Core as it drills because of the machined-in spiral threads running the full length of the body which make automatic runways for removing dust from the hole as it is cut. Each bit has a port opening for cleaning out the core.

T-10-1022

-pot Welder and Solderer

A resistance Spot Welding and Soldering machine (Model 1000WV, or 1000WV—a-c only) is available from Royal Products, Inc., of Newark, N. J.

Designed to speed production in the manufacture of instruments, the machine is said to solder and weld in less than a second. In addition, it silver solders, soft solders and spot welds precious and dissimilar metals, as well as spot welding steel parts up to 3/32 of an inch in thickness. According to the maker, it also will solder brass up to ¼ in. thickness as well as sterling silver and other precious metals.

Colors determine control pressure to protect parts soldered from excessive heat that would cause marking.

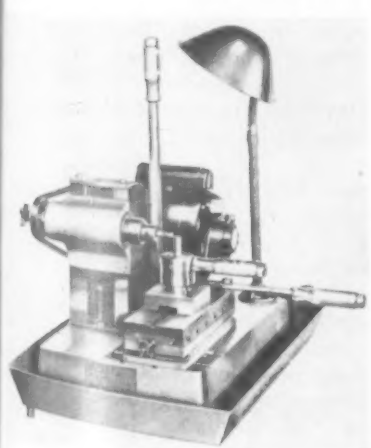
Dimensions are 10 in. long x 11 in. deep x 10 in. high, plus control box 8 in. high.

An automatic cut-off timer regulates soldering time. Heat control with eleven adjustments determines correct heat for the job.

T-10-1031

Combination Tool

The Viking LMG-3 is a combination bench-type production machine which can be set up for turning, milling or grinding through simple changes in tooling. It features a common base, power unit, spindle, and vertical and horizontal slides to which special tooling and fixtures are added for the desired type of lathe, milling or grinding operation.



Spindle speeds with standard pulleys are 825 and 3450 rpm. Additional range of speeds from 100 to 7000 rpm is optional.

One-inch spindle with No. 7 B & S Taper Hole is mounted in heavy ball bearings. Through hole is 13/32 in. in diameter. Spindle is adjustable vertically with maximum 7-in. distance from centerline to work table surface.

Standard type ⅓-hp 1725-rpm motor drives spindle through conventional V-Belt and pulleys, and operates on 60-cycle, 115/230-volt power.

Overall bench space required is 11 in. × 18 in., and table working surface of 6 in. × 9½ in. is provided. Net shipping weight with standard attachments is 145 lb.

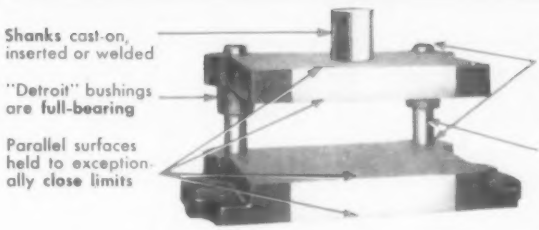
For further information write Viking Industries, Dept. M, 220 Montage St., Rockford, Ill. **T-10-1032**

USE READER SERVICE CARD ON PAGE 115 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

YOU PAY FOR THE BEST . . .
BE SURE YOU GET THE BEST

FACTORY-BUILT IS BETTER-BUILT

When you specify "Detroit" die sets, you are assured micro-metric precision that means: 1) Lower costs in mounting die in die set and 2) Longer, trouble-free production runs. Factory-built die sets give you what you pay for—parallelism, squareness and finish.


Shanks cast-on, inserted or welded
"Detroit" bushings are full-bearing
Parallel surfaces held to exceptionally close limits
Leader pin holes and bushing holes are micro-metric jig bored
"Detroit" precision leader pins are superfinished

Factory-built to the most exacting standards, "Detroit" die sets are also factory-assembled and factory-inspected. You don't have to re-work "Detroit" die sets in your shop to get the accuracy and performance you have a right to expect.

For prompt factory delivery, call "Detroit"

DETROIT	TR 2-5150	NASHVILLE	7-0437
BIRMINGHAM, ALA.	3-1341	PHILADELPHIA	VI 4-4084
BUFFALO	PA 9206	PITTSBURGH	Perrysville 4-5111
CHICAGO	PU 5-7694	ROCK ISLAND, ILL.	R.I. 8-2814
DAYTON	HE 3042	ST. LOUIS	FR 6811
GLEN RIDGE, N. J.	GL 2-5658	ST. PAUL	CE 1600
INDIANAPOLIS	HU 5604	SEATTLE	MU 2450
LOS ANGELES	AD 7251	TOLEDO	MA 4510
MILWAUKEE	GL 3-7170	TORONTO, CAN.	PL 3813
MINNEAPOLIS	PR 1822	WICHITA	5-8682
MONTREAL, CAN.	WI 1186	WINDSOR, CAN.	2-1575

DETROIT DIE SET CORPORATION
2895 W. GRAND BLVD. • DETROIT 2, MICH.

DETROIT DIE SET ★

FOR FURTHER INFORMATION, USE READER SERVICE CARD: INDICATE A-10-103

TRADE LITERATURE

Free Booklets and Catalogs Currently Offered By Manufacturers

Surface Inspection

"Surface Evaluation by Faxfilm" discusses applications and equipment for process employing plastic replica to show surface conditions on wide variety of materials; describes uses for inspection, test and process engineering and for operations in other fields. **The Brush Development Co.,** Instrument Div. 51, 3405 Perkins Ave., Cleveland 14. **L-10-1**

Die Setting

Twenty-page manual discusses company's "Cerromatrix Method" of punch and die setting, with practical information on its application to making various types of dies; clarified by detailed illustrations. **The Cerro de Pasco Corp.,** 40 Wall St., New York 5. **L-10-2**

Rivets

Widely illustrated by drawings showing details of application, specifications and engineering details, recently reissued catalog describes line of rivet tools. **Hi-Shear Rivet Tool Co.,** 8924 Bellanca Ave., Los Angeles 45. **L-10-3**

Metal Cleaning

Illustrated, 44-page booklet, "Some Good Things to Know About Metal Cleaning", offers concise discussion of metal cleaning in its many phases; discusses wide variety of soils resulting from various metal-fabricating processes and describes specific materials, equipment and procedures for their removal. **Oakite Products, Inc.,** 158 Thames St., New York 6. **L-10-4**

Gages

Complete catalog of thread, plug and ring gages presents detailed discussion of company's line; profusely illustrated, with tables of sizes and prices. Some pertinent data tables and technical information also included. **Republic Gage Co.,** 2228 Fenkell Ave., Detroit 21. **L-10-5**

Presses

Four-page technical bulletin VBS-51 describes improved line of "utility" 4- to 10-ton presses; tables give working capacities, and plan drawing shows installation dimensions; illustrated. **Colonial Broach Co.,** Box 37, Harper Station, Detroit 13. **L-10-6**

Screw Products

Booklet, Unbrako "Standards", contains detailed information on company's line of screws and screw products stressing advantages to the customer of using "standards" instead of "specials". **Standard Pressed Steel Co.,** Jenkintown, Pa. **L-10-7**

Tapping

Tapping data book contains useful information for tap and die users; fit, tolerances and other engineering information pertinent to the production of threaded parts are included. **Standard Tool Co.,** Department V., Cleveland. **L-10-8**

Industrial Engraving

Leaflet describes portable engraving machine equipped with a multi-ratio tracing arm for engraving 15 different sizes from one template; stresses economy and simplicity; illustrated. **New Hermes, Inc.,** 13 University Place, New York 3. **L-10-9**

Swaging, Riveting

Production data reports, 30 and 31, emphasize time- and cost-cutting features of its multipress; describing operation, equipment and production method for swaging and multiple punch riveting. **The Dennison Engineering Co.,** Columbus 16, Ohio. **L-10-10**

Diamond Abrasive

Folder introduces diamond abrasive prepared especially for lapping and polishing carbide drawing and heading dies; covers details concerning specific performance and application advantages; contains complete catalog and price data. **Abrasives Div., Elgin National Watch Co.,** Elgin, Ill. **L-10-11**

Automatic Machine

Bulletin pictures and describes company's Dialmatic single spindle automatic, emphasizing design and construction features; complete specification and speed charts included. **The Cleveland Automatic Machine Co.,** Cincinnati 12, Ohio. **L-10-12**

Drill Bushings

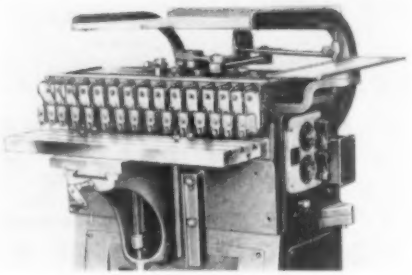
Reference folder presents comparison tables allowing rapid cross reference for the some 3023 symbols used by leading manufacturers of drill bushings, by comparing the many symbols to ASA Standard sizes and specifications; pertinent technical data; price information included. **Ace Drill Bushing Co.,** 5401 Fountain Ave., Los Angeles 29. **L-10-13**

ELECTRIC ETCHING

15 PIECES AT ONE TIME ON HARD OR SOFT METALS

Fifteen tools, gages, or parts of any kind, can be etched electrically at one time—with identifying numbers, names, trade marks, or designs—on hard or soft metals—flat or curved surfaces—with the

JAVELIN ETCHER



Uniform, permanent marking—produced by minute, accurately-controlled, electric arcs. Maximum flexibility for shape and size of work-piece—for design and depth of "copy". No prior or after treatment, no burrs, no marring, no weakening of the product.

Javelin etching, widely used in many industries, does not require skilled labor. Production is faster, cost is lower, than conventional marking or acid etching.

Write for complete specifications to Dept. 1051
See Exhibit 223, Building B, Detroit, October 15-19

ENGIS EQUIPMENT CO. 431 S. DEARBORN ST., CHICAGO 5, ILL.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-104

30-DAY DELIVERY!

SIMPLEST... MOST COMPACT

O-M

AIR HYDRAULIC WATER CYLINDERS

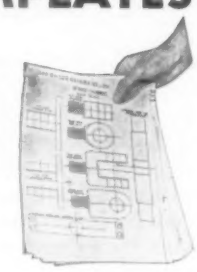
Add up these advantages. They are the reasons why more and more equipment manufacturers are specifying Ortman-Miller cylinders for all types of applications.

Simplicity of design eliminates tie rods and bulky end caps . . . saves one-third in installation space. All parts and mounting brackets interchangeable bore for bore. Cost less to buy, install and service. Full range of sizes (1½" to 8" bores) *available for early shipment.* Machined steel (no castings) and bearing bronze throughout.

Write today for details! Speed production, cut costs and save space with Ortman-Miller cylinders.

FREE TEMPLATES

For the first time in the industry, O-M offers a complete set of templates showing all cylinders and mounting brackets. ½ scale. Your set on request.



ORTMAN-MILLER

MACHINE CO., INC.

1216 150th Street, Hammond, Indiana

INDICATE A-10-105-1

Cutter, Grinder

Catalog M-1734 illustrates and describes Cincinnati's No. 2 cutter and tool grinder plus standard and extra attachments; shows reader pictorially what the machine will do, stressing advantages and special features; includes dimensional drawings and specifications. **The Cincinnati Milling Machine Co.**, Cincinnati 9.

L-10-14

Drills, Twist

Complete line of twist drills featured in 12-page catalog 51-816 covering taper shank, straight shank, three and four fluted drills and drill sets, plus information on company's chatter-free countersinks, and similar items; also contains charts on decimal equivalents of drill sizes, drill feeds and speeds and tips on drill pointings and web thinning; prices included. **The DoAll Co.**, 254 N. Laurel Ave., Des Plaines, Ill.

L-10-15

Metal Finishing

Informative literature packet, "Blueprints for Faster, Better Production", describes in detail company's coated abrasive and solid abrasive oilstone specialties; individual finishing problems and their solutions are presented in case study discussions; folding cover may be expanded into permanent wall chart for handy reference. **Behr-Manning**, Div. of Norton Co., Troy, N. Y.

L-10-16

Gage Blocks

Circular No. 532 pictures both Hoke and U.S.A. carbide precision gage blocks stressing important features; tables give tolerances. **Pratt & Whitney, Div. Niles-Bement-Pond Co.**, West Hartford 1, Conn. **L-10-17**

Shear Selection

Chart simplifies accurate selection of correct rotary shear knife for specific shearing application. Designed for wall hanging near machine. **Simonds Saw and Steel Co.**, Fitchburg, Mass.

L-10-18

Pumps

Four-page Bulletin 46601 illustrates and describes three constant delivery axial piston pumps for pressures up to 3000 and 5000 psi; complete engineering drawings and specification tables explain details. **The Oilgear Co.**, 1585A W. Pierce St., Milwaukee 4. **L-10-19**

Grinding Wheel Bond

Folder gives details on applications and advantages of using recently introduced vitrified silicon carbide grinding wheel bond, "XL"; specifications of the most popular straight and cup wheel sizes for rough and finish grinding included. **Chicago Wheel & Mfg. Co.**, 1101 W. Monroe St., Chicago. **L-10-20**

Who's Training Your New Employees . . .

Don't put your new employee in this position . . . Help him off to a good start with the proper training aids

Now available . . . CARBIDE CUTTING TOOLS, the first authoritative text book on carbides, designed to inform the student, the designer and the man at the machine.

"KNOW HOW"—the best productive use of manpower, machines and materials is essential in our present emergency. It is with this in mind that V-R is making this book available.

CONTENTS: Machine Tools and the Carbides. Converting to Carbides. Tool Angles. Machinability. Tipping a Carbide Tool. Grinding Single-Point Tools. Cutting Power. Speeds. Feeds. Carbide Tool Design. Coolants and Carbide Tools. Carbide Forming Tools. Carbide Milling Cutters. Sharpening Milling Cutters. Multiple-Edge Carbide Tools. Cutting Speeds, Feeds, Forces. Multiple-Edge Tool Design. Selection of a Carbide. Tool Materials, Assembly. Grinding and Use of Tools. Index.

416 Pages. 283 Illustrations.
Washable Cloth Binding. Price $5.50

Companies' purchase orders will be subject to our regular terms. Book orders from individuals should be accompanied by check or money order. Please do not send cash because we will not be responsible. All books shipped prepaid. Offer limited to U. S. and Canada. United States funds only.

With each book purchased for your training program, a complete study guide specially prepared for V-R by the American Technical Society will be furnished without charge—compliments of Vascoloy-Ramet Corporation.

Send all Book Orders to:
EDUCATIONAL TRAINING DEPARTMENT

VASCOLOY-RAMET CORPORATION
WAUKEGAN, ILLINOIS

INDICATE A-10-105-2

GOOD TOOLS . . .
Don't Cost Money
They Make Money

FIGURING TOOL COSTS ON PERFORMANCE . . . NOT PRICE, PAYS BIG DIVIDENDS

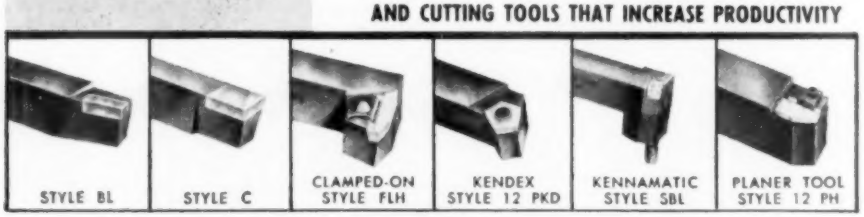
Productivity—not pennies—is the only way to judge the cost of a tool. No tool deserves a place in your shop unless it can prove . . . on the job . . . that it will enable the machine to operate at peak performance, with minimum downtime.

Kennametal cemented carbide tools are made by processes that are exclusive and expensive, but which are worth far more than the cost . . . because they assure a tool material of consistent soundness.

This Kennametal characteristic pays off—in your shop. In many instances, Kennametal tools will pay for themselves in savings effected in grinding, alone. And this does not take into account reduced tooling costs, and improved production rates attained.

We'll send you, on request, reports that show cost reductions of thousands of dollars on many different operations through the use of Kennametal tooling. But—there is a much better way to demonstrate. That's in your shop, on your job. Ask us to do it.

KENNAMETAL *Inc.*, Latrobe, Pa.
MANUFACTURERS OF SUPERIOR CEMENTED CARBIDES
AND CUTTING TOOLS THAT INCREASE PRODUCTIVITY



FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-106

Technical Shorts . .

USE OF A SIMPLE, though unusual method of metal plating developed last in 1948 by Westinghouse Electric Corp. engineers, may conserve the nation's critical nickel and still permit bright corrosion-resistant trim on new automobiles and appliances.

The periodic reverse-current (PR) plating can be applied to such items as auto bumpers, door handles, radiator grilles, toasters, irons and other similar items according to George W. Jernstedt, manager of the company's electroplating projects. "Where no nickel at all is permitted, the process provides a chrome-on-copper finish bright as the standard finish and has satisfactory corrosion resistance. In other cases where some nickel is permitted, PR plating makes it possible to substitute copper for a major part of the nickel normally used, thus achieving a big savings of this critical material," Mr. Jernstedt pointed out.

In this system, a layer of copper about 0.001 in. thick is plated onto the steel base. If nickel is allowed, a layer about one-half the thickness of the copper layer is added. The coating is completed with a film of chrome that may be less than 1/100,000th of an inch thick.

Before nickel was put on the critical list the conventional method was to plate the steel first with nickel and then chrome, according to Mr. Jernstedt. "Although not as scarce as nickel, copper is also a critical material; however, the new plating system requires only small quantities—much less than for other metal substitutes proposed," he pointed out.

Key feature of the process is the short-time, periodical reversal of the plating current. Thus metal is deposited on the surface to be plated, then during reversal, some of it is taken away. surface smoothness and brightness and This makes it possible both to improve to enhance the body quality of the deposit, according to the Westinghouse engineer.

In the copper plating process, the piece to be plated is placed in a bath containing copper in cyanide solution. An electric current passing through the bath causes copper to be deposited on the metal piece—which forms the negative terminal of the system—and dissolved into the bath from a copper electrode which is the positive terminal. The current is reversed after less than a minute, and some of the copper already plated on the metal part is con-

quently dissolved. This cycle is repeated until a satisfactory finish is achieved. The reversed current results in removal of inferior metal deposits as succeeding layers are plated on the metal to produce a finish of superior brightness, strength and freedom from flaws, according to report.

The system, which has been in use at Westinghouse for more than a year, now is being adopted by several automobile manufacturers and suppliers for use on auto parts and accessories.

ALTHOUGH VACUUM metallizing, a process for coating the surfaces of metals, plastics, paper, glass and other materials with an extremely thin adhering metallic film, has been known for over half a century, the development of high-speed vacuum pumps and efficient vacuum processing systems has brought about the possibility of its use as a successful industrial process.

Already it promises to replace many methods of coating as well as making possible the development of new products and applications not readily made by other processes.

The simple working principles of vacuum metallizing include equipment consisting of an airtight chamber in which a high vacuum can be created and held; an evaporation source or holder for the coating material, and jigs for holding the objects to be coated.

Coating material is placed in the source and heated to a temperature at which it evaporates in vaccum, producing vapor particles which travel in a straight line from the source until they strike the material to be coated. In this way, objects can be coated on one side, rotated for coating on all sides, or continuous surfaces may be coated from a roll.

According to F. J. Stokes Machine Co., makers of metallizing equipment, any material with a vapor pressure low enough to permit reaching the operating pressure in the chamber, may be coated. Coating materials may be pure metals, some alloys and a number of the metallic salts.

THE SPEED OF SIGMA welding of stainless and carbon steels has been multiplied through an unusual principle recently announced by Linde Air Products Co., a division of Union Carbide and Carbon Corp. The method involves use of a mixture of oxygen in argon as a shielding atmosphere.

Earlier research indicated that metal transfer consisting of a series of discrete metal droplets propelled at a high velocity made for best welding conditions. Droplet formation varies with different metals and with different current densities.

However, recent studies have shown that the droplet rate, particularly on stainless and carbon steels, can be materially increased by the addition of small percentages of oxygen to highly purified argon. Droplet rate in the oxy-argon mixture is said to have been as much as 50 times greater than in an atmosphere of pure argon. This increase, with no change in current density, permits welding at higher speeds without undercutting, according to report. At the same time overhead welding of stainless steel is said to be made more practical.

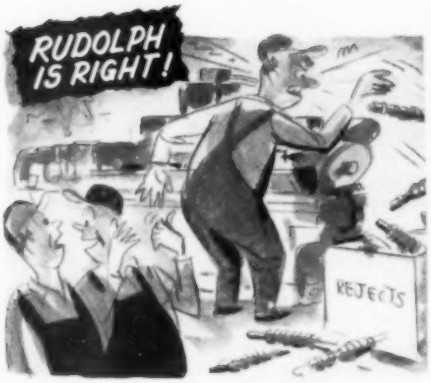
At the same time, welding at lower current densities is possible. Hence, larger diameter rods may be used for a given welding current. If the same size rod now available is used, then thinner materials can be welded.

Because of improved economy and ability to perform welding operations not practicable with straight argon, use of the special argon is expected to expand the application of sigma welding on stainless steel. Increased applications also are anticipated on carbon steels since welding speeds may be doubled, gas consumption correspondingly reduced and less expensive welding rod used.

DoALL precision ground flat stock eliminates costly machining of stock to size, assures you accuracy, fine finish and no shrinkage. Select the sizes you need and you are ready for layout work. *Call DoALL* today.

THE DoALL COMPANY
254 N. Laurel Ave.
DES PLAINES, ILL.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-107



"REJECTS CAN BE MINIMIZED WITH THE RIGHT CUTTING FLUID"

THERE is always one *right* cutting fluid for every machining job—one that will do the job better or faster, or both. Take Rudolph's problem of *rejects.* Here is what one company did about it.

THE OPERATION. Grinding the bearing surface and shoulder on engine camshafts of RC60 hardness.

MACHINES AND WHEELS. Camshaft Grinders with 80 grit wheels.

STOCK REMOVAL. Remove .036" on bearing surface and .012" to .020" on side of shoulder.

PREVIOUS RESULTS. Wheel face dressed after 8 pieces, wheel sides after 3 pieces. *Scrap loss 18%.*

WITH STUART GRINDING OIL. Wheels dressed on face and sides after 18 pieces. *No scrap loss.*

You can secure benefits like this. Ask to have a Stuart Representative call.

Are you receiving Stuart's Shop Notebook regularly?

CONSERVE CRITICAL MATERIALS — Use the RIGHT Cutting Fluid

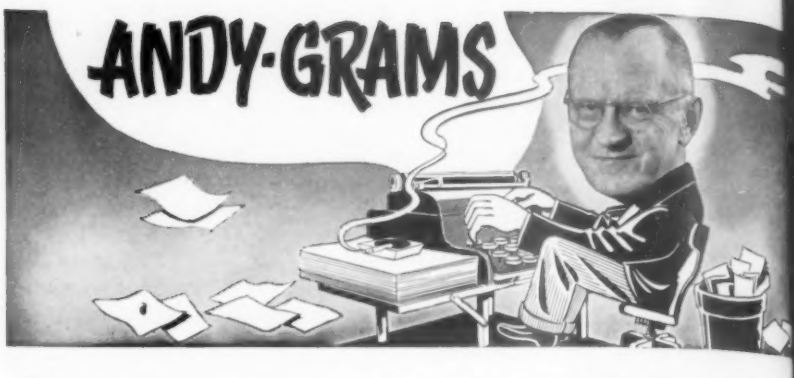
Visit the Stuart Booth No. A-266 at the Metal Show Detroit Oct. 15-19

D.A. Stuart Oil Co.

2727-49 S. Troy Street, Chicago 23, Illinois

INDICATE A-10-108

ANDY-GRAMS



Well, here I am in sunny California, a hundred years too late to be a pioneer yet a settler withal, having bought a home a few days after arrival. Wanted to build and had plans all drawn, but what with late restrictions and priorities it looked like a long wait. The house sets in a court as yet unnamed, although acquaintances have suggested such names as Smorgasbord Road and Lutefisk Lane. I'll settle on Valhalla.

Now for the promised travelogue. Left Detroit 7 A.M. Monday, August 20 with the driver—the Missus, that is; I just sat behind the steering wheel—and granddaughter Linda, and got as far as Princeton, Ill., stopping for the day at 4 P.M. A nice, easy run; no hits, no errors. Next morning, got to Tri Cities too late to catch any of the ASTEers at home, but relayed a message to Elmer Benson. The Mississippi, rolling along as usual, then miles and miles of Iowa corn and friendly people. At 3:30 P.M., called it a day at Atlantic, Iowa, after snaking through sundry detours.

Next morning, at junction of U.S. 6 and Iowa 92, had our only untoward incident when a jaloppy truck, parked at the intersection, suddenly shot into the road. Given a choice between bashing into his rear and diving into a ditch, I compromised and let him sideswipe me with superficial damage. Guy didn't even have a driver's license. At that, he spoiled a record; it was my first accident on the open highway in over 45 years of driving. Knock wood!

Council Bluffs and Omaha, with the Missouri turbing between, then along U.S. 30 to Ogallala, having logged 392 miles by 4 P.M. Ogallala was once a roaring cattle town of which a vestige of frontier days remains; at any rate, it has a good restaurant although, as for that, the further west you go the poorer the steaks. Your best bet is a New York cut—if you can get it. Just beyond Ogallala, you can take your pick between continuing on U.S. 30 through Cheyenne and so on to Salt Lake City, or 138 south to rejoin U.S. 6 and so on to Denver; 30 is the easier route.

I had previously mapped our route as U.S. 6 through Illinois to Omaha, then 30 through Nebraska along the Platte, then 138 into the Rockies. Both trunk roads are excellent, and while we were slowed up by detours these were due to necessary road repairs. Instead of going through Denver, I continued west at Greeley and so through Estes Park and Rocky Mountain National Park. And was that a winding climb to the clouds!

The scenery was gorgeous, but road repairs at about every other turn made driving a chore. Oddly enough, you seem to be going down hill when you're actually climbing steeply. It's only when you see the same road winding upward on the opposite flank of a gorge that you get an idea of the grade. At Loveland, Colorado, by then tired of roadside chow, we bought the makings of sandwiches and picnicked in a lovely park complete with grills and running water. At 4:30 P.M., stopped at Hot Sulphur Springs, having logged 321 miles—a good run considering the terrain. Had intended to stop at Granby, but by-passed it as it was a mile or so off U.S. 40.

I had purposely picked U.S. 40 through the mountains because, being somewhat of a naturalist, I had wanted to stop at Dinosaur National Monument. Instead, stopped at Vernal, Utah, where we went through the museum there, the exhibits of fossil dinosaurs and minerals being of especial interest to grandparents and granddaughter alike. There, too, we picnicked in the park adjacent to the museum.

That afternoon—Friday—we stopped at Heber, Utah, after logging 378 miles, and next morning were passing through Salt Lake City and so on through the desert and over the salt flats. Today, where the emigrants once toiled behind ox-drawn carts, we traverse the wastes in fast cars and over a superlative road in a few hours. Truly the far west can never requite its debt to the pioneers.

Like most western states, Utah has an arbitrary speed limit, reasonable enough in mountainous terrain but

PUMPS

FOR COOLANTS, LUBRICANTS, AND ABRASIVE LIQUIDS

PUMPS

POSITIVE DISPLACEMENT AND IMPELLER TYPES

PUMPS

J. I. C. STANDARDS OR DIRECT MOTOR CONNECTED

PUMPS

FOR TWENTY YEARS—DEPENDABLE, ECONOMICAL, EFFICIENT

Pioneer

PIONEER PUMP

& MANUFACTURING CO., INC.

•

STANDARD OR SPECIAL, FOR EVERY MACHINE TOOL AND INDUSTRIAL USE

19645 JOHN R STREET
DETROIT 3, MICHIGAN

WRITE FOR CATALOG

INDICATE A-10-109-1

rather a temptation to high speeds on the level stretches. The road across the desert, for example, should be safe at 90 for any but a novice driver. However, I was poking along in the 60's when a Cadillac passed me as though I were standing still. Then I passed him when John Law was reading the riot act to the driver.

Stopped at Elko, Nevada, long enough to get me a few silver cartwheels and a good steak dinner at the Stockmen's Hotel. Then on to Winnemucca, where we stayed the night after 355 miles of driving. If Nevada has any speed limits they weren't posted except at towns and villages, and I religiously obeyed limits but made time on the levels to make up for slow mountain driving. Beautiful roads!

Sunday A.M. we crossed the California line and, a few miles further on, were stopped for inspection. However, the guards took one look at the piled-up dunnage and waved us on, not even confiscating the California oranges we'd bought in Iowa. Then, climb, twist and turn over corkscrew roads up and over the Sierras—and boy, were the Sunday drivers out! Let the car out on one of the California freeways, of which there should be more to relieve congested trunk highways. Arrived at daughter's in time for dinner.

Well, it was a wonderful and interesting trip made possible, and on the whole safe, by the genius within the automotive industry and equal ingenuity in the field of highway engineering. For my money, though, they can put back the hand throttle, the right foot tending to become a bit sleepy after a day of stepping on the gas. At that, my blessings on the inventor of fluid drive; it's easy on the car and easy on the driver. But that, as Kipling said, is another story.

Anyway, I'm here, and so far have had a wonderful reception, even as I had a royal send-off from ASTEers and other friends on leaving Detroit. I must have lived right after all. Hope to broaden my acquaintanceships among West Coast tool engineers during the next few weeks, and will tell you about it in the November Andygrams. At any rate, I've an idea that I'm going to be happily busy doing the things I want to do. And that's living!

ASTEely yours

Andy

ENGINEERS

TO DESIGN, REDESIGN, OR DEVELOP YOUR PRODUCT

ENGINEERS

TO TOOL AND EQUIP YOUR PLANT FOR THE BEST PRODUCTION ECONOMICS

ENGINEERS

TO GET YOUR NEW PRODUCTION GOING AND KEEP IT GOING

ENGINEERS

TO REDUCE YOUR COSTS AND IMPROVE YOUR QUALITY

PIONEER ENGINEERING

& MANUFACTURING CO., INC.

•

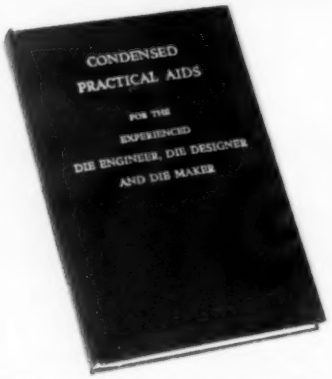
ENGINEERS, DESIGNERS, CONSULTANTS AND PRODUCTION SPECIALISTS

19645 JOHN R STREET
DETROIT 3, MICHIGAN

INQUIRIES PROMPTLY ANSWERED

INDICATE A-10-109-2

Here is the DIE BOOK you've always wanted!



ANSWERS TO OVER 1,000 PRACTICAL DIE PROBLEMS WITH USE OF DIRECT READING TABLES AND FORMULAS

ALL IN ONE COMPACT HANDBOOK

Gives you direct answers to die problems. Saves hundreds of hours of time. Eliminates laborious mathematical calculations. Avoids costly errors of Cut and Try Methods. Contains formulas and tables that the experienced die man encounters every day. Formulas in this book have been used for many years by leading die manufacturers and have proven accuracy. Quick reference—Instantly available.

Formulas and Direct Reading Die Tables covering die problems on the following types of dies:

BENDING AND FORMING DIES
BLANKING DIES
DRAWING DIES
SQUARE AND RECTANGULAR
DRAWN SHELLS
MISCELLANEOUS TABLES AND CHARTS

All in one compact experience-tested handbook—reduced to a matter of seconds—may be carried in pocket or tool box.

Write for Bulletin No. 77

MONEY BACK GUARANTEE

Ten days' free examination to prove its dollar saving value. Remit only $3.50 plus postage. $3.00 on 6 or more. We pay postage if check or money order accompanies order.

"DIE TECHNIQUES" Publishers
350 N. Clark St., Chicago 10, Ill.

Please send on approval a copy of your Condensed Practical Aids for Die Engineers, Designers and Die Makers.

☐ Enclosed $3.50 for one book

☐ Enclosed ($3.00 each for 6 or more)

Name .....

Position .....

Firm .....

Address .....

INDICATE A-10-110

North East West South IN INDUSTRY

Proctor H. Avon has been appointed division engineer of **Monsanto Chemical Company's Merrimac Division.** Mr. Avon, who joined Monsanto in 1937, succeeds **John S. Hayes,** who has been promoted to assistant director of the company's general engineering department.

At a recent meeting of the board of directors, **William H. Harris, Jr.** was elected vice-president in charge of engineering of **Micromatic Hone Corp.** Mr. Harris, who previously was chief engineer of the organization, holds several honing patents in addition to having been a contributor to various technical publications.

William Harris, Jr.

M. E. Peterson

M. E. Peterson has been named to the post of general manager of **Clearing Machine Corporation's** recently purchased plant in Hamilton, Ohio. Mr. Peterson, who was to have headed the company's activity in Joliet, Ill., has been with Clearing in various executive capacities since the firm was formed in 1933.

The Cro-Plate Co., Inc. has announced today the election of **Alan W. Brown** as president, succeeding the late Theodore L. Brantly, Jr. Mr. Brown, co-founder of the company, was executive vice-president and has been in charge of manufacturing and engineering operations.

Simultaneously, announcement was made of the election of **Robert C. Allen,** previously treasurer, as executive vice-president and treasurer.

Daco Machine and Tool Co. has announced the appointment of **Frederick Nueske** as master mechanic in charge of tooling of precision instruments. Mr. Nueske, 40-year veteran production counselor, is the former owner of the Nueske Machine and Tool Co.

The honor of election to honorary membership in the **Institute of British Foundrymen,** London, England, has been conferred upon **Oliver Smalley,** president of **Meehanite Metal Corp.** The organization, which is interested in development activities in the foundry industry, confers such memberships in recognition of services to the foundry industry by an individual over a long period of years.

The appointment of **James F. Eversole** as manager of research administration of **Union Carbide and Carbon Corp.** was recently announced. Dr. Eversole, who joined the chemical research organization of the corporation as a research chemist in 1929, will help coordinate the research activities of all of the corporation laboratories where basic research and development work is being done on alloys, chemicals, gases, carbons and plastics.

Announcement from the **Acromatic Tool Co.** has named **A. William Tilder** as vice-president and general manager of the organization. With 25 years' experience in the cutting tool field, Mr. Tilder goes to Acromatic from the Whitman & Barnes division of United Drill & Tool Corp. where he was a division manager.

Executive changes made recently by the board of directors of **Allis-Chalmers Manufacturing Co.** included the election of four new vice-presidents: **W. G. Scholl** in charge of sales for the tractor division; **C. W. Schweers** in charge of sales for the general machinery division; **J. F. Roberts** in charge of engineering for the general machinery division; and **W. A. Yost,** a vice-president of the general machinery division.

At the same time **G. F. Langenohl,** assistant treasurer, was elected to the position of treasurer and appointed assistant secretary.

Robert R. Simons has been elected vice-president of the **Sharonsteel Products Co. of Pennsylvania,** a warehouse subsidiary of the Sharon Steel Corp. Mr. Simons, who joined Sharon Steel in 1942, succeeds **T. J. Moore, Jr.,** who will now devote his entire time to the Brainard Steel Co., also a Sharon subsidiary.

cording to recent announcement, H. Borchardt has been elected a president of **Worthington Pump & Machinery Corporation.** Mr. Borchardt, who has many years' experience with Worthington, will have overall responsibility for the sale of the corporation's entire line of pumping equipment. Mr. Borchardt also is a past president of the Hydraulic Institute.

Fred Bohle has been named manager of the recently organized machine tool development department of **Illinois Tool Works.** He will have authority over all phases of development, design, production and sales of the company's machines. Mr. Bohle, who has been associated with Illinois Tool since 1935, formerly was chief engineer of the company's tool division.

Clinton B. Burnett has been appointed director of engineering of **Johns-Manville Corp.** according to recent announcement. Mr. Burnett, who is vice-president of the organization, was formerly production manager of the company's building products division.

Carl Ahlstrom, retired 50-year man from **Norton Company's** Grinding Machine Div., recently participated in the cornerstone laying ceremonies which marked the beginning of the largest expansion in Norton's Machine Div. since 1943. A copper box containing mementoes of the firm's 51 years in the grinding machine business was sealed into the cornerstone.

Coming Meetings

Oct. 11-12, 14th annual fuels conference of Coal Div., AIME, and Fuels Div., ASME; Roanoke Hotel, Roanoke, Va.

Oct. 12-14, annual meeting, **Metal Treating Institute;** Detroit.

Oct. 15-19, 33rd annual ASM Metal Show, to be held in conjunction with the Metallurgical Congress; Detroit.

Oct. 31-Nov. 2, 15th annual National Time & Motion Study Clinic sponsored by **Industrial Management Society;** Sheraton Hotel, Chicago.

Nov. 1-4, National Tool & Die Manufacturers Assn. convention Statler Hotel, St. Louis.

Nov. 8-9, annual national conference on industrial hydraulics under the sponsorship of **Illinois Institute of Technology** and **Armour Research Foundation;** Sherman Hotel, Chicago.

Nov. 19-20, 52nd annual convention **National Metal Trades Assn.;** Palmer House, Chicago.

Paul W. Arnold and **Richard A. Geuder,** two top engineers of **The Reliance Electric & Engineering Company,** have been elevated to new responsibilities in the company's general sales organization. Mr. Arnold, formerly manager of product sales, moves up to the recently created post of executive assistant to the sales vice-president; while Mr. Geuder, who has headed the company's application engineering work, becomes manager of a department of applied engineering and industry sales.

Recent appointment of **Gilbert I. Clark** to the post of project engineer has been made from the **American Cladmetals Co.** Mr. Clark formerly was with General Electric's aircraft gas turbine division.

Simonds Saw and Steel Co. and **Simonds Abrasive Co.** have moved their combined office, shop and warehouse from 127 South Green St. to 3323 West Addison St., Chicago.

The newer quarters add almost 14,000 square feet of floor space, now all on one level, where up-to-date facilities are slated to make for rapid handling.

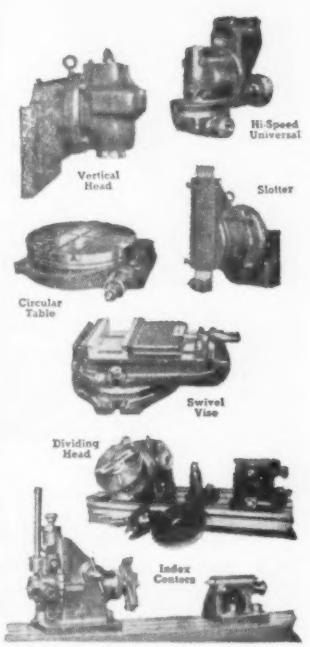
Why wait? Perhaps the Job Can be Done on a Standard Machine with Kempsmith Attachments

You know — it's really surprising how many difficult milling operations can easily be handled by Kempsmith Standard Attachments mounted on a standard milling machine.

Manufacturers faced with urgent production schedules are utilizing Kempsmith Standard Attachments to help solve their milling problems. These precision-built accessories are made to perform the most delicate milling operations, with speed and accuracy. They frequently eliminate the need for special, single-purpose machines, at the same time reducing production costs to rock bottom.

Look to Kempsmith for milling machines, attachments, arbors and accessories. They are backed by more than 60 years specialized experience in this field.

Write for bulletins describing Kempsmith Standard Attachments, Arbors and Accessories.



KEMPSMITH MACHINE CO., 1847 S. 71st St., Milwaukee 14, Wis., U. S. A.

KEMPSMITH

Precision Built Milling Machines Since 1888

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-111

Good Readin

A GUIDE TO SIGNIFICAN BOOKS AND PAMPHLET OF INTEREST TO TOOL ENGINEERS

CONDENSED PRACTICAL A FOR THE EXPERIENCED DIE E GINEER, DIE DESIGNER AND MAKER. Published by Die Techniq 350 North Clark St., Chicago 10, Price $3.50.

Collected in this pocket-size volu are the results of years of practical perience in the die designing and building business. The book is mea for the practicing engineer in the industry, and will be of no value to t layman or beginner.

The basic die formulas, which quire an extensive knowledge of mat matics to use, have been included a the calculations have been converted direct-reading charts and tables ready reference. These charts a tables should prove a time saver in t development of blanks for forming di bending dies, draw dies, extrusion di shave dies and blanking dies.

INTRODUCTION TO MECHA ICAL DESIGN, by T. B. Jefferson a Walter J. Brooking. Published by t Ronald Press Co., New York, N.Y. 6 pp.; price $6.50.

This book, which won first award i the machine design division of the com petitive program for modernized tex books on design sponsored by the Jame F. Lincoln Arc Welding Foundation, embraces 17 chapters and a compre hensive appendix, the whole providing a textbook not only complete from a prac tical viewpoint, but which follows close ly the mode of creative thinking of en gineers actually engaged in machine and tool design.

In this work, the authors give the reader benefit of broad practical as well as theoretical experience. T. B. Jefferson is editor of *The Welding Engineer* and formerly design engineer, Office of Chief of Engineers, U. S. Army, while Walter J. Brooking—now with the Special Projects Department, M. W. Kellogg Co.—was but recently dean of LeTorneau Technical Institute. He has also contributed articles to *The Tool Engineer*. The work has been edited by Burgess H. Jennings, professor of mechanical engineering and chairman of the Department of Mechanical Engineering, The Technological Institute, Northwestern University. The authors

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-112

approached the work as a whole in light of functional purposes of a ine, its requirements and economic derations, the use of rational and ical design data, and desired final arance, all in proper perspective as hed by the experienced designer. inst this background is presented entary theory of the machine ele- s usually covered in textbooks; the work is of equal value to both essional engineers and students. On whole, a truly valuable contribution e "know-how" of mechanical de-

EW LESSONS IN ARC WELDING, the Lincoln Electric Co., Cleveland, o. 320 pp.; price $1.00 in the S.A., $1.50 elsewhere.

This book is based on lessons and in- ctions given at the Lincoln Arc ding School; consequently, the les- s are practical rather than theoreti- and cover basic fundamentals of welding as well as more advanced ding in alloys, sheet metal and pipe. e basic 32 lessons cover welding mild el in all positions, while 29 advanced sons cover other welding applica- s.

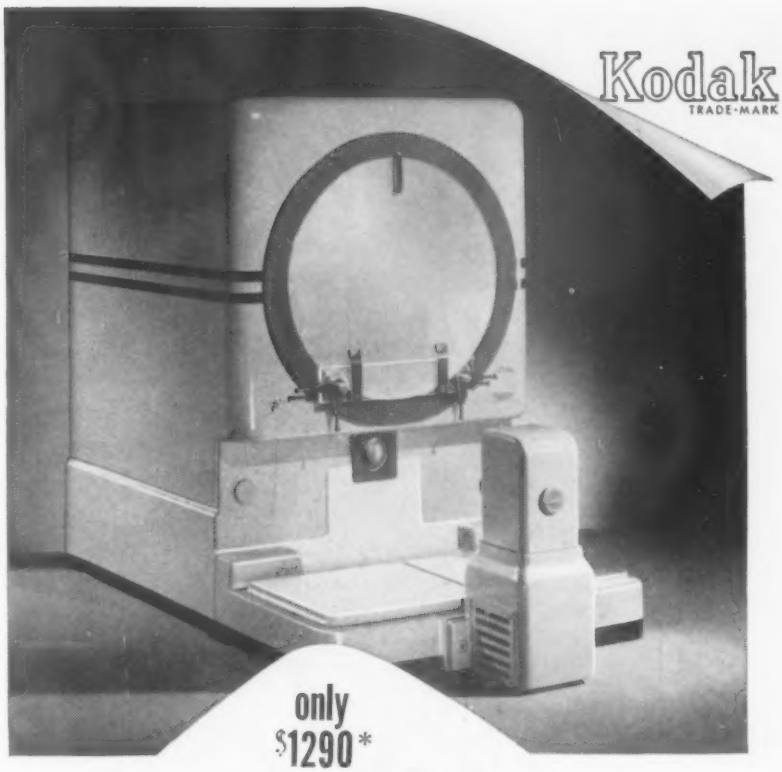
Explained are: latest welding pro- dures for faster, low cost welding; tomatic and semi-automatic hidden welding procedures; how metals are de and how to identify them; how to ect correct welding joints; and how make common machine parts by lded fabrication instead of by cast- g.

PRINCIPLES AND METHODS OF HEET METAL FABRICATION, by eorge Sachs. Published by Reinhold ublishing Corp., New York, N.Y. 526 p.; price $10.00.

This work gives an unusually broad nsight into the techniques of sheet metal fabrication in that it describes in ystematic order and in considerable detail the principles of numerous meth- ds of forming and processing. Illus- rations are clear and informative, and he whole covers the theory of deforma- ion of sheet metal and tubing, the metallurgical effects produced in stamp- g, bending, extrusion and allied pro- esses as well as design of parts and dies.

Theoretical concepts are tied into practical problems with emphasis on "how-to-do-it", and numerous examples of commercial work are analyzed to pro- ide clear understanding of specific jobs. An authoritative work of especial nterest to die engineers and others en- aged in sheet metal fabrication.

(Continued on page 114)



a new instrument for fast accurate assembly and inspection

It's a new version of the unique Kodak Contour Projector, stripped of toolroom features for greater flexibility in getting out production on all sorts of precision jobs, small or large.

1. At any magnification up to 100× you get the same 8 inches of free space from lens to object. This makes it easy to design fixtures that handle parts fast.
2. The projector body (with all optical parts dust-sealed in because they never need adjustment), the work stage, and the front lamp house all come apart. You can attach them in any combination to a big fixture for holding heavy parts.
3. There's an accessory for vertical projection if that's better for your work than horizontal.
4. There's another accessory for examining surface detail and deep recesses by light coming right out of the lens that picks up the image.
5. The 14-inch screen is so uniformly bright that no hoods, curtains, or darkened rooms are required.

We'll be glad to arrange a demonstration on your own special problems. Write Eastman Kodak Company, Industrial Optical Sales Division, Rochester 4, N. Y.

the KODAK CONTOUR PROJECTOR, model 3

Distributed by ENGINEERS SPECIALTIES, Buffalo 9, N. Y.
*List price, F. O. B. Rochester, N. Y., lenses and accessories extra, price subject to change without notice.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-113

Drilling Large Holes from the Solid?

Send for this Catalog TODAY!

Immediate Delivery

on all Conner Standard Tools

CONNER TOOL & CUTTER CO., 1000 E. McNichols Rd., Detroit 3, Mich.

Please send me your new spade drill catalog immediately . .

NAME _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE ____ STATE _____

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-114

GOOD READING . . .

(Continued from page 113)

METAL PROCESSING, by Or... William Boston, Professor of Me... Processing and Chairman, Departme... of Metal Processing, University ... Michigan. Published by John Wiley ... Sons, Inc., New York, N.Y. 763 p... price $7.50.

In this second edition the auth... gives essential information needed ... the complete preparation of routi... including the selection of machine too... cutting tool materials, tool shap... speeds, feeds and the accessories i... volved in manufacture and plant la... out.

The first chapter covers the steps i... volved in designing for productio... while the following chapters treat th... various classes of machines and th... processes and factors with which the... are involved. Written by an authorit... in the field of metal processing, th... book omits little if anything needed fo... a complete grasp of the general subje... which, in turn, is so sub-classified tha... the reader has insight into all essenti... details of manufacture up to and in... cluding routing of materials and fina... inspection.

PRODUCTION CONTROL, by Franklin G. Moore. Published by the McGraw-Hill Book Co., New York N.Y. 455 pp.; price $5.50.

This book, which is slanted to course... in business administration, explains in considerable detail how production con... trol is accomplished and why the par... ticular methods employed are used. Ad... vantages as well as limitations of var... ious methods have been quite thoroughly examined and as thoroughly dis... cussed.

Especially, the author considers pro... duction control as dealing in trans... mission of information, the authority to perform operations along with ability to check on their performance. Included are such topics as engineering drawings and drawing numbers; material identi... fication systems; and relationship of departments concerned with controlling production.

Chapters are arranged topically, with 70 short study problems—all adapted from actual use—covering the various subjects. The numerous illustrations are fully explained to show their rela... tionship with the text material, the whole of particular interest and value to students since it points out that the best procedures are as varied as the situations in which they operate. How... ever, the author emphasizes the need of adapting each procedure to individual situations or application...

THE TOOL ENGINEER'S *Service Bureau*

TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

LITERATURE NUMBER	COMPANY	BULLETIN	DESCRIPTION
-10-140	ALLEGHENY LUDLUM STEEL CORP.		"Cutting Tool Materials" offered as guide to quick answers to cutting-problems questions; presents basic facts on various materials to aid in proper selection for specific uses.
-10-122	AMERICAN BROACH & MACHINE CO.	450	Thirty-two page catalog of practical broaching information.
-10-28	F. E. ANDERSON OIL CO.		"Lusol—the all-chemical Metalworking Solution" discusses advantages and main features of this cutting oil.
-10-86	ARMSTRONG-BLUM MFG. CO.	ST-650	Bulletin describes line of high-speed-edge hole saws.
-10-180	BALAS COLLET MFG. CO.	50	Catalog and price list covers line of Balas collets.
-10-143	CHARLES H. BESLY & CO.		Booklet of abrasive wheels and discs gives up-to-date information modern grinding abrasives.
-10-175	BETHLEHEM STEEL CO.	261	Presents detailed discussion of company's "XX" Cold-Heading Die Steel.
-10-160-1	BOICE-CRANE CO.		Catalogs covering various tools in company's line.
-10-26	BROWN & SHARPE MFG. CO.		Complete catalog covers company's line of cutters.
-10-152	THE CARPENTER STEEL CO.		"How to Get Better Tool and Die Performance" tells about Carpenter's "Vega" tool steel, its advantages and features.
-10-156-3	CHICAGO RIVET & MACHINE CO.		Catalog contains engineering information and rivet specifications plus illustrated descriptions of rivet setters.
-10-137	CHICAGO WHEEL & MFG. CO.		Literature and engineering report tells about "XL" bond silicon carbide grinding wheels.
-10-164	CINCINNATI LATHE & TOOL CO.	CO-15	Catalog discusses Cincinnati's Royal Radial drill.
-10-8	THE CINCINNATI SHAPER CO.	N-5	Catalog deals with company's line of shapers.
-10-155-3	THE CLEVELAND TAPPING MACHINE CO.	T-8	Production tapping guide available in addition to the catalog of company's line.
-10-23	COLONIAL BROACH CO.	BN-1250	Bulletin board poster of Do's and Dont's to aid in reducing broach maintenance cost.
-10-114	CONNER TOOL & CUTTER CO.		Spade drill catalog treats problem of drilling large holes from the solid.
-10-168	CRUCIBLE TOOL STEEL SELECTOR		Tool Steel Selector aids in choosing proper steel for particular use.
-10-110	"DIE TECHNIQUES" PUBLISHERS	77	Discusses information in compact handbook on dies.
-10-159	THE DOALL CO.		Twenty-page bulletin describes gage blocks and accessories and modern measurement control
-10-167	THE DOALL CO.		Brochure tells about machining facilities offered by DoAll band machines.
-10-142	THE EASTERN MACHINE SCREW CORP.		Various catalogs describe "Selecting Proper Die Head for the Job", Style MM, Style DMS, Style DM, and Style TM machines for cutting screw threads.
-10-95	ETTCO TOOL CO., INC.	72A	Bulletin presents details concerning company's foot or air operated 72A tapping machine.
-10-100	GOLCONDA CORP.		"The Story of Sta-Sharp Diamond Tools" gives full details and prices on Golconda's diamond tools.
-10-156	GORHAM TOOL CO.		Gorham Tool Catalog illustrates and describes complete line of cutting tools, plus informative section of engineering data.
-10-172-2	GROBET FILE CO. OF AMERICA, INC.	HC1	Catalog sheet treats Grobet chatterless countersinks.
-10-97	HAMMOND MACHINERY BUILDERS, INC.	701	Bulletin deals with motorized solid carbide insert grinding fixture.
-10-30	HANNA ENGINEERING WORKS	236	Full information on Hanna low pressure cylinders.
-10-3	HARDINGE BROTHERS, INC.	Style "S" Style "B"	Bulletins give performance features, price savings and ordering information on master feed fingers and pads.
-10-121	ILLINOIS TOOL WORKS		"Metallurgy in Tool Design and Production" gives characteristics of various tool steels, different types of surface treatments with advantages they give.

USE THIS HANDY FORM ➡

to obtain further information about advertisers, trade literature or tools of today appearing in this issue of THE TOOL ENGINEER. No postage needed.

THE TOOL ENGINEER, DETROIT 21, MICH.

READER SERVICE CARD

Please send me further information as indicated below:

(Mark Key Number of trade literature, tools or advertisements)

ADVERTISERS	TRADE LITERATURE	TOOLS OF TODAY
A—	L—	T—
A—	L—	T—
A—	L—	T—
A—	L—	T—

NAME _____ POSITION _____

FIRM _____ BUSINESS _____

Please Check One ☐ Firm Address ☐ Home Address } STREET _____

CITY _____ ZONE NO. _____ STATE _____

THE TOOL ENGINEER'S *Service Bureau*

TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

LITERATURE NUMBER	COMPANY	BULLETIN	DESCRIPTION
A-10-176-2	KAUFMAN MFG. CO.	1150	Catalog gives information of precision built tapping machines.
A-10-16	THE LAPOINTE MACHINE TOOL CO.	DRV-5	Bulletin deals with company's double ram vertical broaching machines.
A-10-158-4	W. F. MEYERS CO.	13	Descriptions of bushings with emphasis on economy features contained in catalog.
A-10-4	MICHIGAN TOOL CO.	1458A	Bulletin announces Michigan's high production-high speed gear hobber, giving important features.
A-10-173	MILLER MOTOR CO.	A-105 H-104	Brochures discuss Miller cylinders stressing standard features adhering to ASA Standards.
A-10-19	NATIONAL BROACH & MACHINE CO.	849-S	Detailed treatment of gear tooth crowning offered in company bulletin.
A-10-20	NIAGARA MACHINE & TOOL WORKS	86	Bulletin announces "Hi-Production" circle shear and flanger pointing out its operational advantages and special features.
A-10-132	NORTON CO.	Form 501	"Barrel-Finishing with Alundum Tumbling Abrasive" gives information on this abrasive plus practical hints on barrel finishing problems.
A-10-163	NORTON CO.	Form 2006	"The A B C of O.D. Grinding" gives facts of cylindrical and centerless grinding; provides convenient selection charts.
A-10-158-3	OAKITE PRODUCTS, INC.	F7993	Booklet describes "New Metal Cleaner Removes Oil and Rust in One Operation"
A-10-84	O'NEIL-IRWIN MFG. CO.		"Die-Less Duplicating" catalog presents story of Di-Acro punch and press equipment
A-10-105-1	ORTMAN-MILLER MACHINE CO., INC.		Free set of templates showing all O-M cylinders and mounting brackets; half scale.
A-10-21	A. SCHRADER'S SON		Information on the Schrader ClampAir and valves.
A-10-182	THE SHEFFIELD CORP.	B-380-50	Literature contains specifications for series 5/380 gear deburizers.
A-10-27	SCULLY-JONES AND CO.	4-50	Bulletin deals with Scully-Jones tap holders and drivers showing range of sizes, specifications and prices.
A-10-93	THE STANDARD ELECTRICAL TOOL CO.	TW	Twin wheel tool grinder for carbide, stellite or high speed steel tools is subject of bulletin covering details and advantages.
A-10-134-3	P. A. STURTEVANT CO.		"Sturtevant Torque Manual" presents valuable data to aid manufacturer, design and production men.
A-10-90	SUPER TOOL CO.	Supplement No. 4	Catalog supplement lists full details of quality solid carbide tipped twist drills in company's stock.
A-10-179	SWARTZ TOOL PRODUCTS CO., INC.	941	Catalog presents information on company's standard drill jigs and fixture locks.
A-10-147	VANADIUM-ALLOYS STEEL CO.		Booklet "Die Steels for Hot Work" deals with line of steels for various jobs.
A-10-134-2	THE VAN KEUREN CO.	34	Two years of research represented in 208-page handbook and catalog of data on measuring and gages.
A-10-13	VERSA-MIL	6	Twenty-four page bulletin contains specifications and capacities, illustrates typical uses of company's equipment for milling, boring and grinding.
A-10-134-1	WAUKESHA TOOL CO.		Illustrated catalog, "Quality Cutting Tools", gives complete specifications of Waukesha tools.
A-10-118	WENDT-SONIS CO.		Carbide Equivalent Chart shows carbide manufacturers' grade recommendations.
A-10-102	S. B. WHISTLER & SONS, INC.		Two catalogs, one on magnetic, the other on adjustable, perforating dies, give complete details with prices and application illustrations.
A-10-146	WIEDEMANN MACHINE CO.	241	Bulletin describes efficient method of producing chassis and similar work in short runs and semi-production runs.
A-10-83	WILTON TOOL MFG. CO.	101E	Informative, 32-page catalog tells about Powrarm work positioners emphasizing cost-cutting advantages.

BUSINESS REPLY CARD
No postage stamp necessary if mailed in the United States

FIRST CLASS
PERMIT NO. 10782
(Sec. 510, P.L. & R.)
DETROIT, MICH.

THE TOOL ENGINEER
ASTE Building
10700 Puritan Ave.
Detroit 21, Mich.

ATT: READER SERVICE DEPT.

USE THIS HANDY FORM

to obtain further information about advertisers, trade literature or tools of today appearing in this issue of THE TOOL ENGINEER. No postage needed.

Abstracts of Foreign Technical Literature

By M. Kronenberg

Great Britain: High stress concentrations and similar disadvantages inherent in conventional spline shafts can be avoided by adoption of noncircular profiles for shafts and their mating members, when the prevention of relative angular motion between fixed or sliding machine parts is necessary. A machine for grinding such noncircular profiles has been developed in Europe before the last war and is described in an improved design in the British edition of *Machinery* of July 19.

This grinding machine can be employed to generate eccentric or elliptical profiles and also for grinding three lobed or four lobed internal or external parts. It is claimed that the new machine element which may replace the conventional spline shaft in the future can be produced easily on the machine, called "K-profile grinder". The production of noncircular workpieces is obtained through a motion which is imparted to the grinding wheel center by a mechanism in the headstock, which is shown in detail in the article.

A new British standard (No. 1638—1950) has recently been published concerning the selection of ranges, types and sizes of engineering products, and it is hoped, according to an article by P. Grodzinski in the British edition of *Machinery* of August 9, that this subject will be studied by those responsible for determining the basic dimensions of such products. The standard covers so called preferred numbers and provides all data necessary for establishing suitable ranges of lengths, diameter, capacities, etc., whereby attention is drawn to two textbooks recently published on this topic. The one by O. Kienzle, who for more than 30 years has been an authority on preferred numbers and standardization, gives all details for preferred numbers as far as they affect the selection of gears, tools, machine tools, torque exerted with levers, handles, knobs, etc. The other one by S. Berg covers the laws of similarity and the author suggests that more attention be given in English speaking countries to the preferred number system because dimensioning affects directly the work of the production and tool engineer.

H. G. Conway, in an article published in *The Engineer* of July 20,

A "stock quotation" that pays big dividends

SIMONDS ABRASIVE CO.

Grinding Wheels

"All the boys ask for Simonds wheels," says the storekeeper. Why? Because they can count on top production and fewer rejects with Simonds Abrasive Company wheels. They're proven producers—accurately specified for every job . . . a real investment in greater grinding efficiency for you. Free data book describes Simonds complete line of grinding wheels, mounted wheels and points, segments and abrasive grain. Write for it . . . and the name of the Simonds distributor ready to serve you.

SIMONDS ABRASIVE CO., PHILADELPHIA 37, PA. BRANCH WAREHOUSES: CHICAGO, DETROIT, BOSTON
DISTRIBUTORS IN PRINCIPAL CITIES

Division of Simonds Saw and Steel Co., Fitchburg, Mass. Other Simonds Companies: Simonds Steel Mills, Lockport, N. Y., Simonds Canada Saw Co., Ltd., Montreal, Que. and Simonds Canada Abrasive Co., Ltd., Arvida, Que.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-141

Choose from a complete range of sizes . . . wide selection of styles . . . straight or taper shanks. Quick delivery on all W-S tools from your nearest Wendt-Sonis distributor.

FREE! SEND TODAY for CARBIDE EQUIVALENT CHART, showing carbide manufacturers' grade recommendations.

WENDT SONIS

HANNIBAL, MISSOURI

CARBIDE TIPPED CUTTING TOOLS

BORING TOOLS • CENTERS • COUNTERBORES • SPOTFACERS
CUT-OFF TOOLS • DRILLS • END MILLS • FLY CUTTERS
TOOL BITS • MILLING CUTTERS • REAMERS • ROLLER
TURNING TOOLS • SPECIAL TOOLS

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-119

recommends more general adoption of the so-called ISA tolerance system. It indicates that this tolerance system is the most modern and comprehensive system and that it is difficult to find any reason why the ISA system should not replace the obsolete (British) B.S. 164 system.

The ISA system covers the requirements of a variety of industries from gage making down to the black nut and bolt trade and therefore would find general use. The fact that the tolerance system has not been developed in Great Britain, is, in the author's opinion, no reason for not adopting it. He quotes numerous examples showing how well the ISA system covers even difficult cases such as the fitting of a tapered roller bearing into the magnesium wheel of an aircraft part, requiring a fit of considerable interference owing to the high elasticity of the light alloy. In this instance, it was possible to use one of the extreme undersize holes in the ISA system with great success.

France: Roll grinding, including determination of deformations and deflections of rolls used in rolling mills and in the paper manufacturing industries is discussed in an article by Abbé Cayere in the March edition of *La Machine Moderne*.

After covering the theory of measuring surfaces on workpieces with large radii of curvature the author presents test results of high accuracy obtained with a new measuring instrument. This instrument consists substantially of a double suspended water level with a microscopic attachment and permits a very rapid measuring of the inaccuracies of rolls ground on roll grinders whereby the effect of the weight of the rolls is duly taken into consideration. It is claimed that this relatively simple device can also be used for measuring alignment and straightness of long machine tool beds and for similar other purposes.

The international confusion existing in the field of measuring hardness of metals is the topic of an interesting article by G. de Smet published in the May issue of *La Machine Moderne*. The author indicates that the problem of measuring hardness is as old as when, nearly two hundred years ago, the French physicist Muchenbrook stated that a definition of hardness is one of the scientific problems which cannot be solved. Still today no uniform definition of hardness exists or has generally been accepted making it necessary to specify always the method used such as "Brinell" or "Rockwell C" or "Knoop" etc.

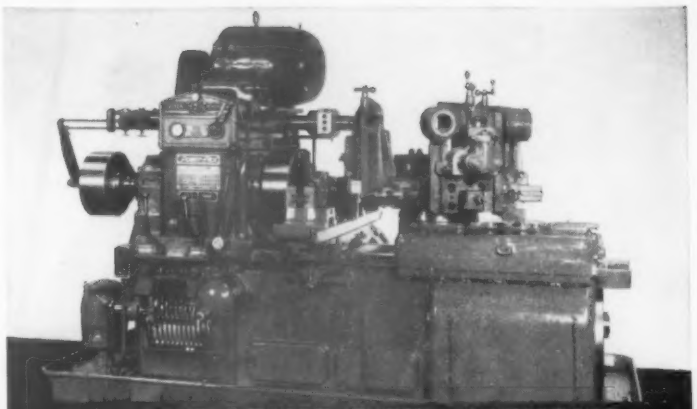
After a thorough study of the numerous devices on the market for measur-

(Continued on page 120)

One SET OF COMBINATION TOOLING ON THE P&J 5D AUTOMATIC DOES IT FOR ALL 4 JOBS

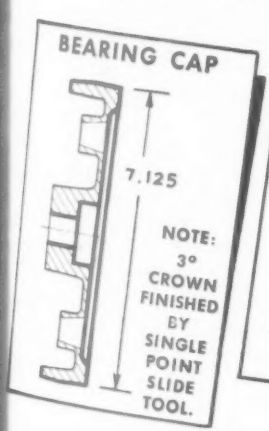
(SECOND OPERATIONS INCLUDED)

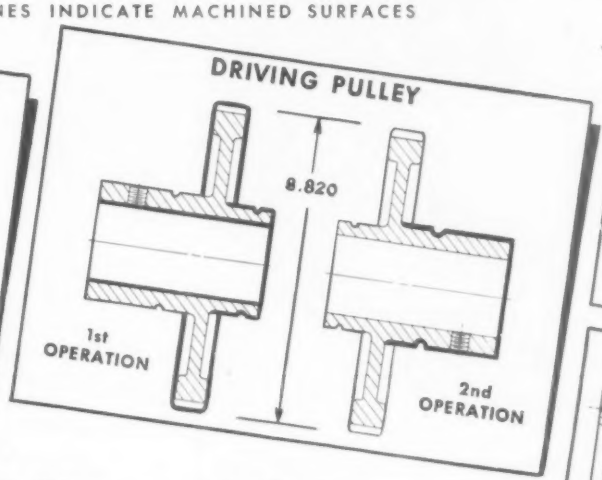
HEAVY LINES INDICATE MACHINED SURFACES

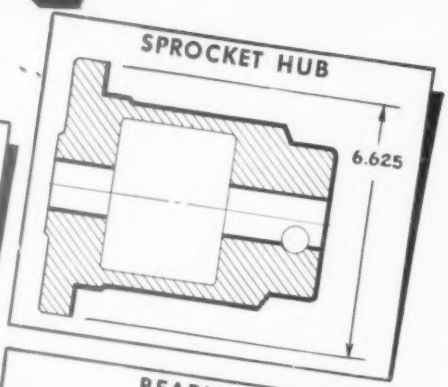


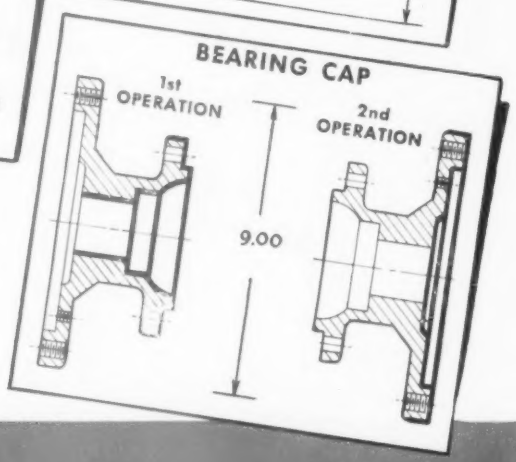
P&J 5D POWER-FLEX AUTOMATIC

Available in 3 sizes: Standard, Elevated and Long Travel. Swing over bed 30"; swing over cross slide 17". Spindle speeds up to 610 rpm.









Numerous similar examples of productivity with P&J Tooling on P&J AUTOMATICS are illustrated in this free Booklet. Write for your copy.

POTTER & JOHNSTON Co.

Subsidiary of PRATT & WHITNEY
Division NILES-BEMENT-POND COMPANY
PAWTUCKET, RHODE ISLAND, U. S. A.

Precision Production Tooling for 53 years

P&J

Modern Design SPEEDS PRODUCTION

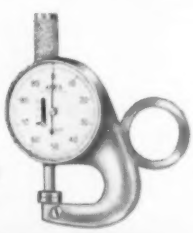
AMES

● Ames micrometer dial indicators are the most modern available today —and naturally so because Ames policy for over 50 years has been continually to improve design, to take advantage of new materials and to utilize the most advanced manufacturing methods. They are a real aid to the quality control engineer who is trying to keep pace with today's high production schedules.

Because Ames Indicators are functionally designed, they have fewer parts than ordinary indicators. Construction is simple with functional parts being larger and more rugged and adequately supported. Operational friction is at a minimum. Thus, Ames Indicators combine extreme sensitivity and accuracy with the ability and endurance *to stay right on the job longer.*

√ *Check this list of features . . .*

1 Forged Solid Brass Case and Stem
2 Heavy Brass Plate
3 Coarse Pitch Stainless Steel Rack
4 Hardened and Burnished Steel Pivots
5 Dials Printed from Steel Engravings
6 Patented Bezel Assembly



Representatives in principal cities. B. C. AMES CO. *30 Ames Street Waltham 54, Mass.*

Mfgr. of Micrometer Dial Gauges • Micrometer Dial Indicators

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-129

Abstracts of Foreign Technical Literature

(Continued from page 118)

ing hardness, including those by measuring microhardness, the author states that the multitude of solutions and definitions by individual manufacturers leaves the impression of disorder and scientific chaos. He suggests calling an International Congress together for the purpose of establishing rigid definitions and standards for hardness of metals.

The generation of polygonal sections on automatic screw machines is discussed by André Peskine in the May issue of *La Machine Moderne.* The article covers both the theoretical analysis of the geometric relationships of the motions involved and the means for practical application.

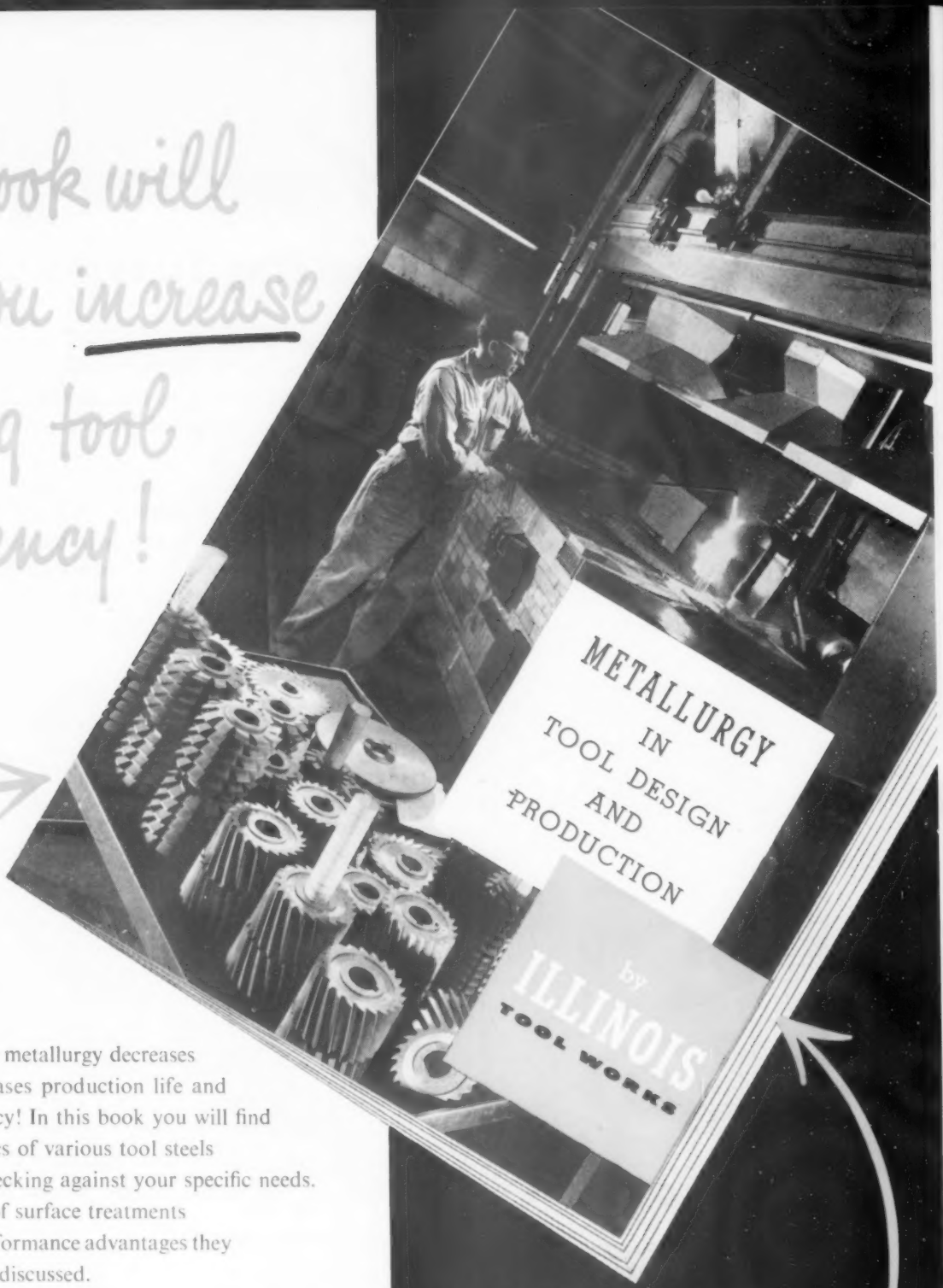
Switzerland: Extensive tests have been carried out by G. Lorenz in the machine tool laboratory of the Engineering College at Zurich investigating the effect of grinding methods on the surface finish of the workpiece. These tests are described in No. 7 of *Industrielle Organisation* of July.

The author found that the number of revolutions which a point on the workpiece completes while traveling along the entire width of the grinding wheel is a convenient measure for relating machining data to surface finish. The investigation was limited to grinding of steel bar stock approximately equivalent to SAE 1065; it was concluded from the tests that the hardness of the workpiece does not affect the quality of surface finish, likewise a depth of cut of less than 0.0004 in. has no effect on the surface quality. The author ventilates therefore the problem as to whether it is necessary to design grinding machine with infeeds of as little as 0.00004 in.

Among other findings the author confirmed the fact that the number of strokes when dwelling can improve surface finish, but usually not to such an extent as to justify the increase in grinding time. He also found that the surface finish is greatly improved after dressing the wheel, while the grinding wheel speed has no such effect. The surface speed of the workpiece, however, often has considerable effect on the finish depending on the quality of the grinding wheel.

Straight lines in a bilogarithmic field are obtained when plotting the surface finish is RMS versus the above mentioned criterion for the grinding data. From these graphs it is possible to derive standards for the selection of grinding wheels.

this book will help you increase cutting tool efficiency!



See how modern metallurgy decreases tool costs, increases production life and improves accuracy! In this book you will find the characteristics of various tool steels tabulated for checking against your specific needs. Different types of surface treatments and the tool performance advantages they give you are also discussed.

Send For Your Free Copy Today!

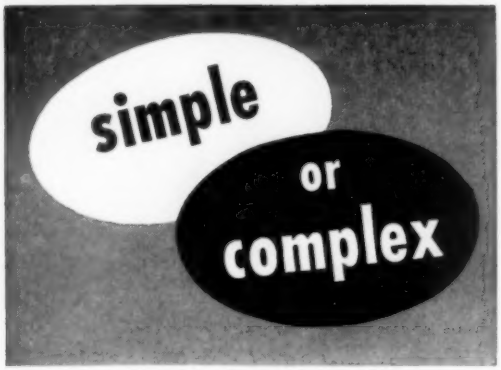
ILLINOIS
TOOL WORKS

2501 North Keeler Avenue
Chicago 39, Illinois

At Illinois Tool Works, a staff of experienced tool metallurgists and the latest laboratory and processing facilities are at your service . . . ready to help solve your tool metallurgy problems and increase your cutting tool efficiency!

ILLINOIS TOOL WORKS INC. CHICAGO 39, ILLINOIS

"Headquarters For Engineered Cutting Tools"



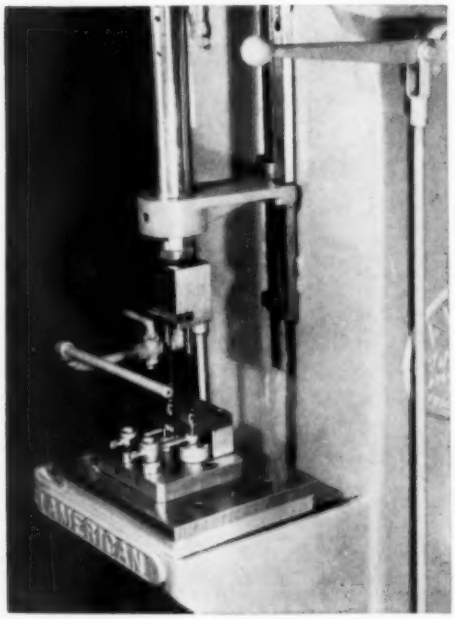
American - ENGINEERED

Broaching Fixtures CUT COSTS

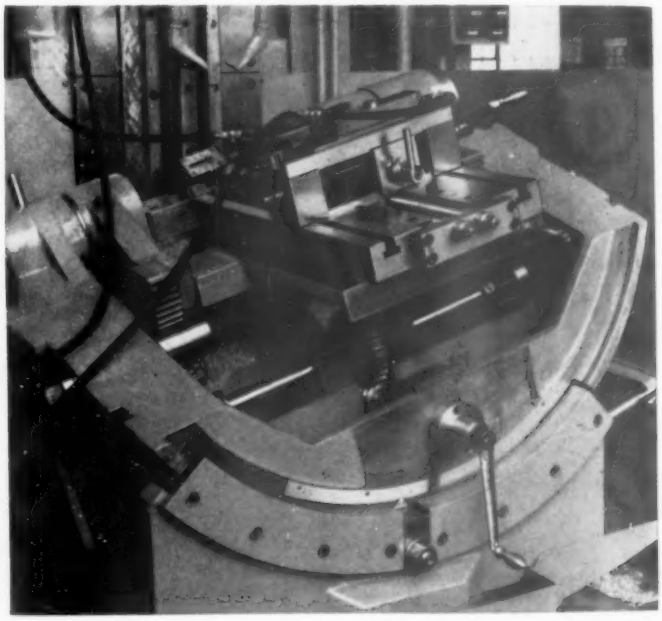
Efficient, economical production is the goal of broaching fixture design. Sometimes this goal is reached best with a simple fixture, designed for complete manual operation. At other times it means a highly complex fixture, engineered for multiple purposes, and equipped for automatic or semi-automatic operation.

The right fixture for your production needs probably lies somewhere between these two extremes. You can be sure of getting the right fixture . . . by having it designed and built by American engineers.

American offers you the advantage of over twenty-five years experience in the design and production of fixtures, broaches and broaching machines. This experience is your assurance of a fixture designed to do your job efficiently and economically. Write for their recommendations. Enclose a part print or sample, hourly requirements and type and model machine to be used. No obligation, of course. Address Dept. T.



This SIMPLE fixture helped one manufacturer cut costs by adapting an American V-1 two ton press to push down broaching of small motor connecting rods. Parts are located from the large hole and swung easily into position. The broaches are arranged to strip back through the work. A plate above the work prevents parts from lifting. An example of how an American-engineered fixture solved a broaching problem.



This COMPLEX fixture permits a milling cutter manufacturer to broach serrations in slots on different sizes of cutters. This versatile fixture permits tilting for helix and conical angles, and adjusting "in and out" as well as laterally to compensate for various sized milling cutters.

Write today for your copy of Catalog No. 450, 32 pages packed with useful, practical broaching information.

AMERICAN — American BROACH & MACHINE CO.

A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

ANN ARBOR, MICHIGAN

SUNDSTRAND

See American First — for the Best in Broaching Tools, Broaching Machines, Special Machinery

THESE ARE SOME OF THE THINGS A WELL-RUN EXPOSITION IN *YOUR* FIELD DOES FOR YOU:

- Brings your prospects to you
- Enables you to actually demonstrate your products
- Renews customer contact
- Introduces new products quickly
- Establishes contact with people your salesmen can't reach
- Produces inquiries and leads
- Opens new markets for you
- Builds sales organization confidence
- Establishes your firm
- Enables you to broaden your sales organization

NOTHING TO SELL ?

One of the most trying times any company can go through is when it is "sold out".

With nothing to sell, contacts with customers and prospects inevitably lag, morale of the sales organization weakens, worries mount as to what you will do "when the rush is over".

There is a simple answer to all this—the exposition which covers your and your customers' trade or industry—the one time and place where your customers and prospects will come to see YOU.

By exhibiting, you renew and maintain your customer contacts, you can discuss 'future business', you maintain and rebuild morale in your sales organization, you keep your company and your products 'sold'.

The one time you should *not* fail to exhibit is when you have "nothing to sell".

ASTE INDUSTRIAL EXPOSITION

March 17-21, 1952 Chicago, Illinois

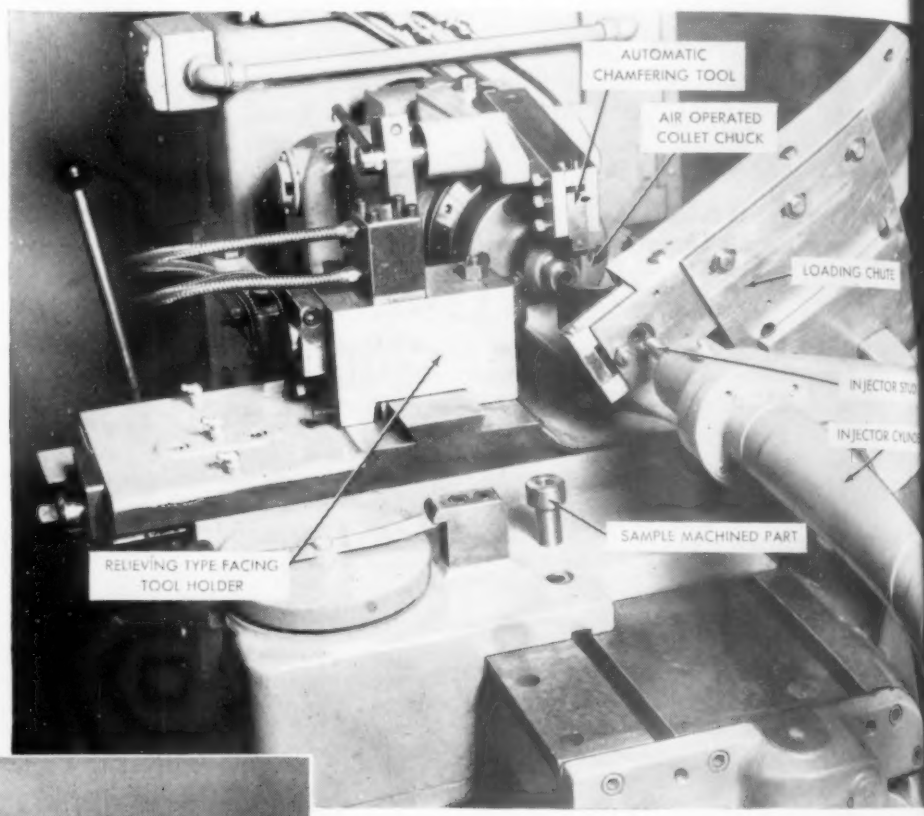
American Society of Tool Engineers

10700 Puritan Avenue Detroit 21, Michigan

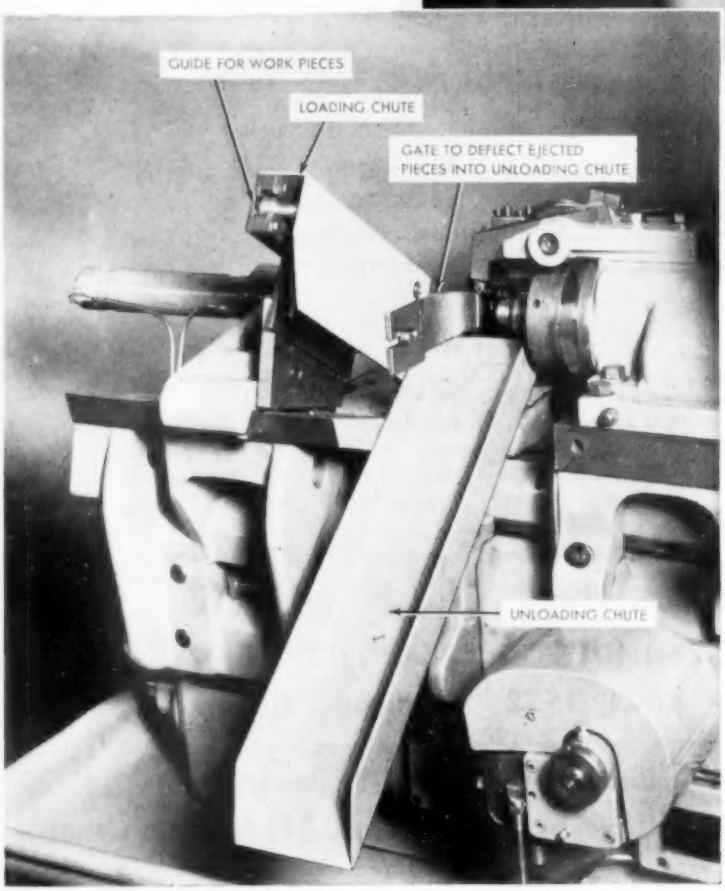
MACHINE OF THE MONT

PREPARED BY THE SENECA FALLS MACHINE CO. "THE Lo-swing PEOPLE" SENECA FALLS, NEW

Automatic Loading enables the machine to produce to its full mechanical efficiency by eliminating the human equation.



AUTOMATICALLY LOADED IMP LATHES CUT MANUFACTURING COSTS



Problem: To finish face and chamfer bore of pu gear true with bearing diameter.

Solution: The Lo-swing IMP Lathe selected for job was fitted with an injector type automatic loa which provides a very fast, completely automatic cy entirely eliminating hand loading and assuring a c stant flow of machined parts at exceptionally low per piece.

The partially machined pump gears are placed i loader chute and fed by gravity to the loader injec arm which picks up and places the part in an air op ated collet chuck.

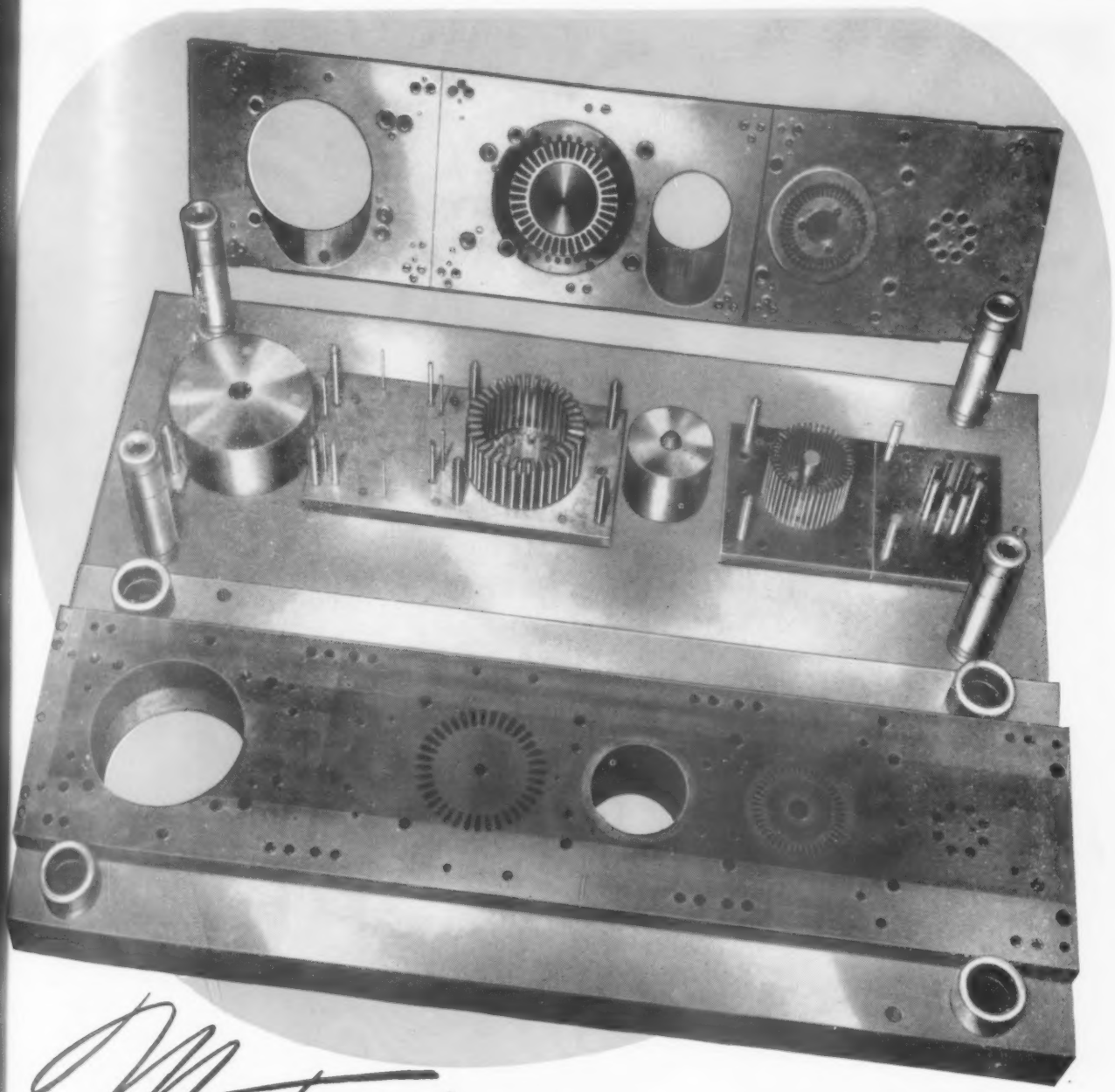
The facing operation is accomplished with a relie type tool block mounted on the front slide. The t is automatically relieved during the return stroke avoid spiral tool marks. The chamfering operat of the bore is made with a swinging type tool bl mounted on the headstock and automatically opera with a cam mechanism working in conjunction w the front cross slide.

On completion of the machining operation the pu gear is automatically ejected by a plunger located in bore of the spindle after which the cycle is repeat

Lo-swing Lathes fitted with Automatic Loaders usually grouped together in series of two or mo since one operator can easily keep the loading chu on several machines filled with pieces.

Seneca Falls engineers are always at your disposal find cost cutting solutions for your turning proble

PRODUCTION COSTS ARE LOWER WITH Lo-swing



Masterpiece by CROMOVAN

100,000 pieces per grind . . . 100% increase in production over former dies . . . is the outstanding performance of this Cromovan six station, progressive lamination die. The die punches out both rotor and stator laminations complete . . . from .025 silicon lamination sheets . . . clearance tolerance of .0007 inch per side is strictly maintained between punches and die. All cutting surfaces of this die are made of CROMOVAN.

R248

VISIT OUR BOOTH G-446 AT THE A. S. M. SHOW

SEE THE NEW METHOD-X MACHINING SINTERED CARBIDES, SUPERALLOYS AND OTHER "NON-MACHINABLE" METALS.

Firth-Sterling

STEEL & CARBIDE CORPORATION

General Offices: 1330 Forbes St., Pittsburgh, Pa.

OFFICES: NEW YORK · HARTFORD · PHILADELPHIA · PITTSBURGH · CLEVELAND · DAYTON · DETROIT · CHICAGO · LOS ANGELES

PARKER • MAJESTIC PM PRECISION MACHINES

Above is pictured the home and products of the

PARKER-MAJESTIC, INC.

For over twenty-one years this company has manufactured the Parker Spindles used in Precision Grinding, Boring and Milling applications.

Supplementary products include the well known line of Parker-Majestic Internal, External, No. 2 Surface and Rotary Surface Grinders.

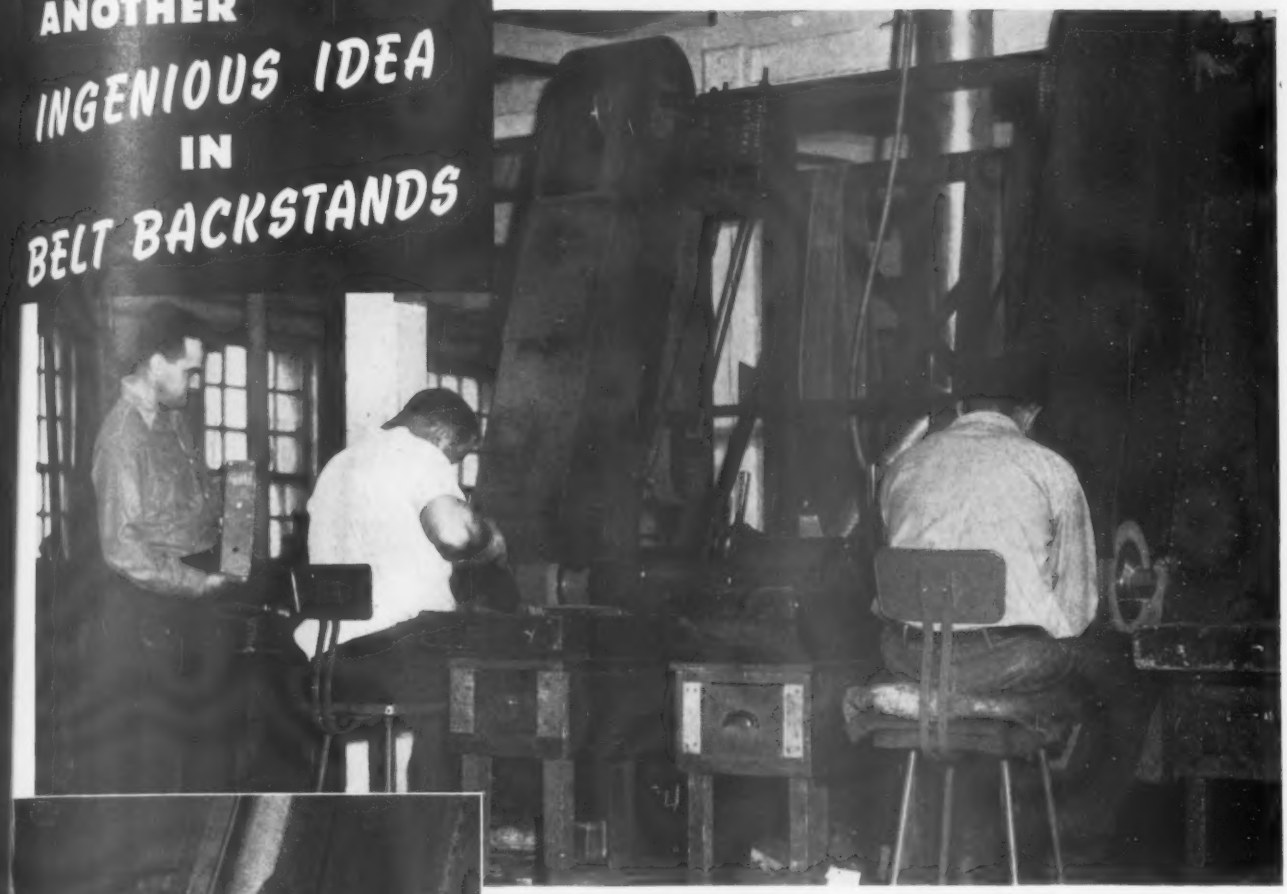
Descriptive literature upon request.

PARKER-MAJESTIC, INC.

formerly MAJESTIC TOOL & MFG. CO.

147 JOS. CAMPAU • DETROIT 7, MICHIGAN

ANOTHER INGENIOUS IDEA IN BELT BACKSTANDS



Close-up of finishing on a door-plate, initial and final operations entail simply a quick move from one belt to the other.

Photographs by Coale Pictures, Berlin, Conn.

The profit-saving advantages of finishing with BEHR-MANNING abrasive belts, are doubly realized in this backstand arrangement at P. & F. Corbin, Division of The American Hardware Corp., New Britain, Conn., prominent manufacturers of building hardware. Here are the big points:

1. **A TWO-MOTORED LATHE,** so the operators work independently, and stoppage of one does not stop the other —
2. **TWO CONTACT WHEELS** and belts (rough and finish) at each end of the lathe. Belts are only a few inches apart, making the roughing and finishing almost a single operation on each piece —
3. **BACKSTANDS ARE RAISED ABOVE,** instead of extending back of contact wheels. The supporting structure is mounted on the lathe itself. Valuable floor space is saved.

This ideal arrangement was devised by Mr. Max Grapski, the company engineer, with the cooperation of a BEHR-MANNING Engineer.

ARE YOU HANDLING your finishing operations the most profitable way? Why not utilize the experience of BEHR-MANNING Engineering Service. No obligation. Write to Dept. TE-10

BEHR-MANNING®

NORTON abrasives®

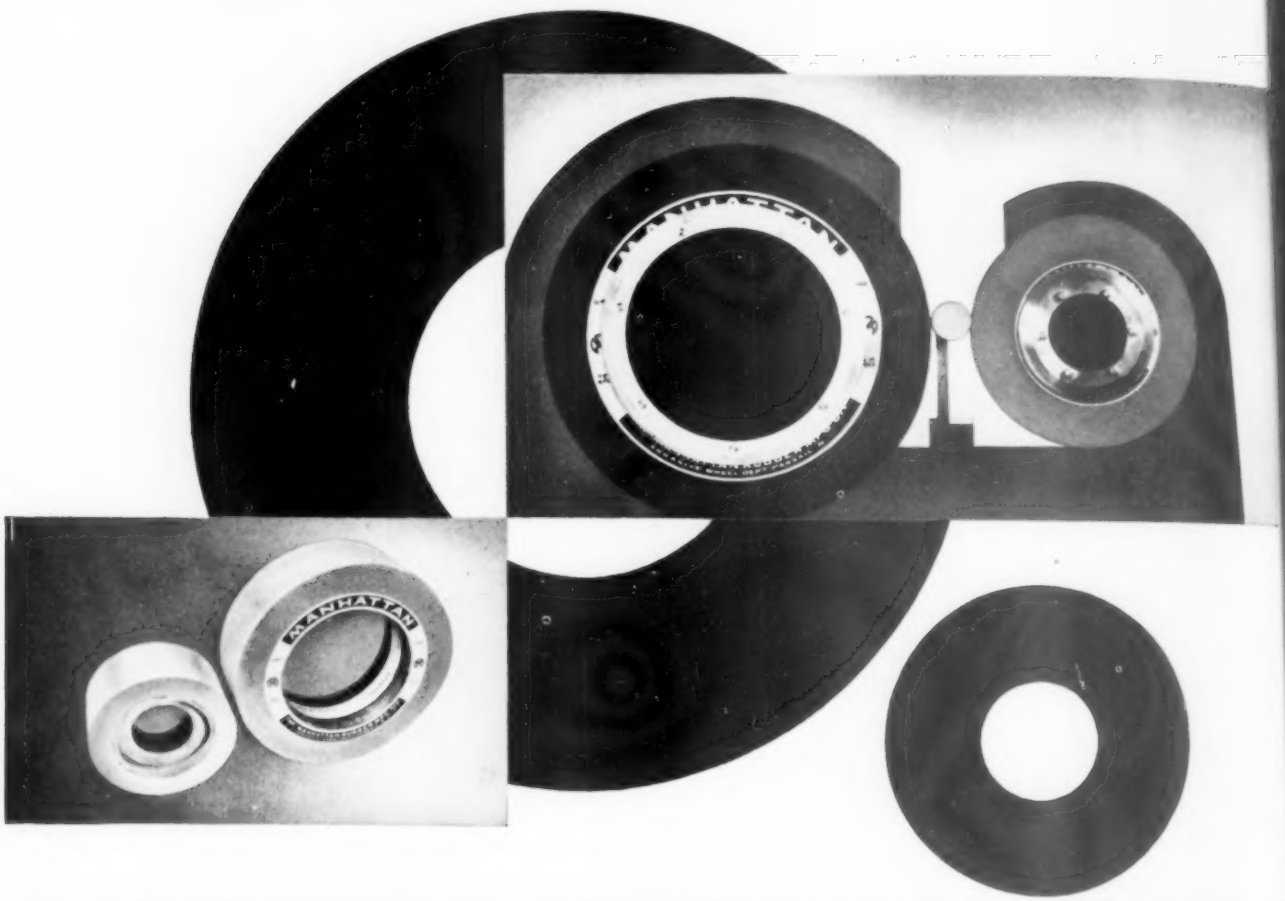
BEHR-MANNING • TROY, N. Y.

COATED ABRASIVES • SHARPENING STONES

PRESSURE-SENSITIVE TAPES

EXPORT: BEHR-MANNING OVERSEAS INC., NEW ROCHELLE, N. Y., U. S. A.

ROUGHING AND FINISHING WITHOUT CHANGING WHEELS



MANHATTAN CENTERLESS WHEELS

Using the same wheels for two jobs—roughing and finishing—saves two ways . . . Saves on wheel inventory . . . Saves wheel changing and machine setting time. Both savings lower your production costs with no reduction of quality.

Manhattan Centerless Wheels are custom-tailored for your work. This means higher output per wheel . . . and per man-hour.

Regulating wheels are supplied plain or core-mounted. Manhattan core mountings also effect substantial savings.

WRITE TO ABRASIVE WHEEL DEPARTMENT

MANHATTAN RUBBER DIVISION

RAYBESTOS-MANHATTAN, INC.

PASSAIC, N. J.

Manufacturers of Mechanical Rubber Products • Rubber Covered Equipment • Radiator Hose • Fan Belts • Brake Linings • Brake Blocks • Clutch Facings • Packings • Asbestos Textiles • Powdered Metal Products • Abrasive & Diamond Wheels • Bowling Balls

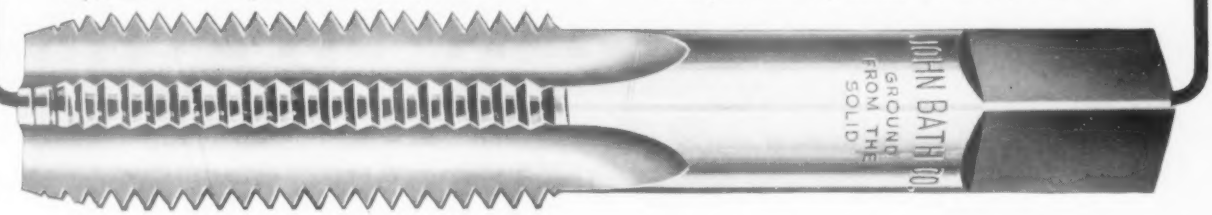
Remember the political boss of yore,
Who loved to "tap the oil" galore?

But the very same oil, in front of his Wife,
Heated her temper, all through Life.

JOHN BATH CO. INC. · WORCESTER · MASS ·

When you "oil a tap", you'll soon go "berserk"
If you use the same grade for all kinds of work.

Use the right lubrication, according to rule,
And your Bath Tap temper will always stay cool!



INSIST ON BATH TAPS . . . PROFIT BY THEIR PLUS-PERFORMANCE

When tapping threads, a lubricant is required with the right body, flow and penetration so that the fluid will follow the cut and provide a film to eliminate metallic contact. It should also keep the tap cooled to the proper temperature. Selection of the lubricant should be determined by the type of job, the metal, the machine — and other important factors.

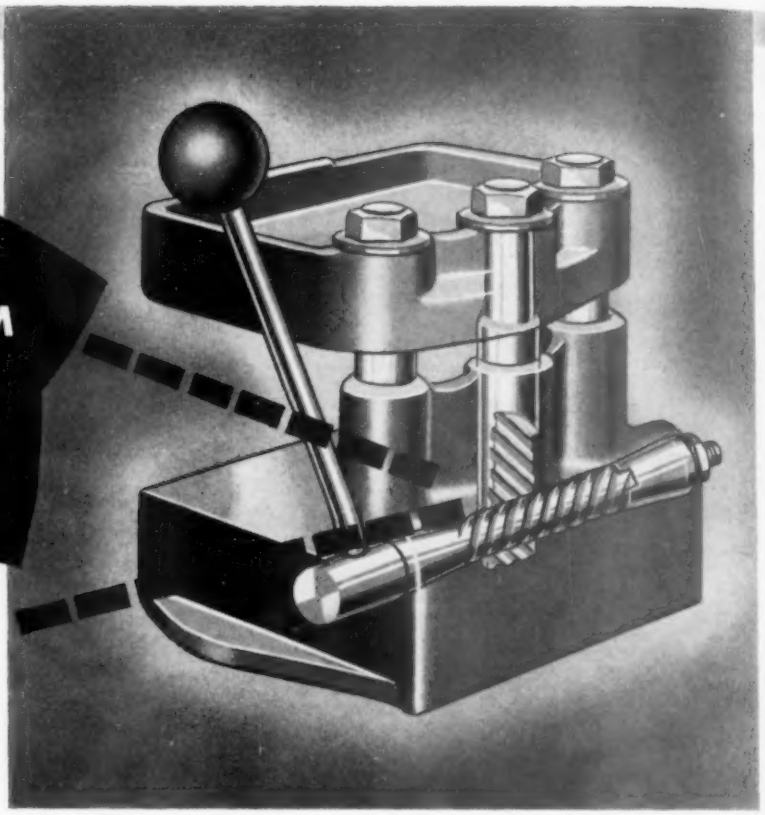
During these critical times, our sales representatives in the field and our engineers have a single desire — to help you speed up production without any sacrifice in quality. The benefit of our threading experience is yours for the asking.

PLUG AND RING THREAD GAGES • GROUND THREAD TAPS • INTERNAL MICROMETERS

JOHN BATH CO. INCORPORATED
28 Grafton St., Worcester, Mass.

LOCKING MECHANISM WEARS IN —NOT OUT

"CONE-LOK"



THE JIG WITH A LIFETIME* *Guarantee* ON THE LOCKING MECHANISM

● Just think of this. It's no longer necessary to carry an inventory of spare parts. And when you eliminate costly inventory you *save again* in storage space and taxes! Add to this the saving on maintenance costs and down time on production. Don't overlook these values when planning your 1950 program. Write for literature, complete details.

** We absolutely guarantee forever the locking mechanism on the Cone-Lok.*

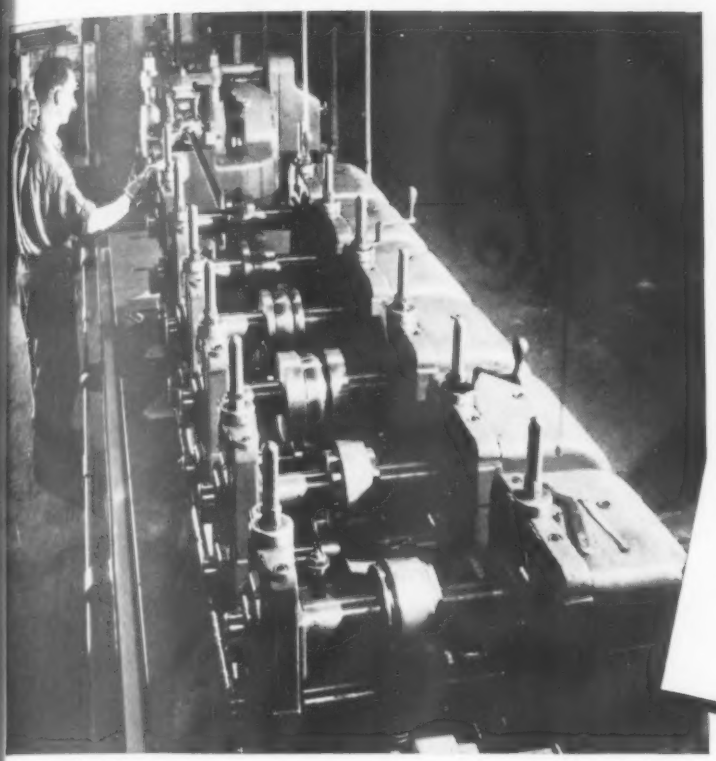
WOODWORTH

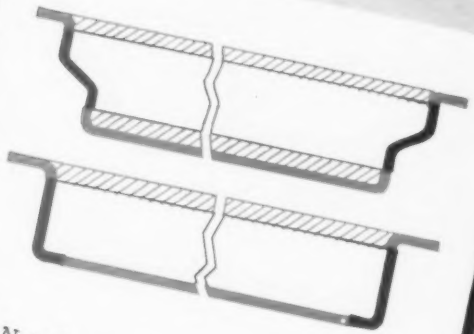
N. A. WOODWORTH CO. • 1300 EAST NINE MILE ROAD • DETROIT 20, MICHIGAN

PRECISION GAGES • DIAPHRAGM CHUCKS • CONE-LOK JIGS • PRECISION PARTS

12 EXAMPLES OF ECONOMIES

effected by combining different operations in a YODER Roll Forming Machine





Note the part of two hat shapes, used in making baffle rings for jet engines, shown in black. The remainder, shown in color, represents scrap. By cold roll forming only the profiles used, bending and welding into rings, the excessive scrap loss of nearly 80% is avoided.

No. 12. Up to 80% saving in material cost by cold-roll forming, avoiding former heavy scrap loss

Of all the methods available for cold-shaping flat rolled metal, the cold roll forming machine offers the highest production per man hour and the lowest conversion cost. It is often a good investment even when operated only a few days per month.

Of still greater importance than conversion cost is often the saving of weight which may be effected by designing light, strong box, tubular and other special structurals to take the place of hot rolled angles, channels, tees, etc. Material savings up to 50% are frequently made.

In press forming of hat shapes to make stator rings for jet engines, up to 80% of the metal has to be cut away and discarded in order to obtain one ring. By cold roll forming the profile from strip, cutting to length, bending into rings and joining ends by welding, this huge scrap loss is avoided. Here is another example of how a Yoder cold Roll Forming production line may save scarce and expensive stainless steel, aluminum, brass and other metals. In such cases, the material savings alone may be many times greater than the conversion cost, even for relatively small quantities.

Function, scope, and economics as well as mechanics of cold roll forming, are discussed in Yoder's 86-page illustrated book which will be sent on request. Recommendations and estimates for the asking.

THE YODER COMPANY • 5525 Walworth Avenue, Cleveland 2, Ohio, U. S. A.

Complete Production Lines

- ★ COLD-ROLL-FORMING and auxiliary machinery
- ★ GANG SLITTING LINES for Coils and Sheets
- ★ PIPE and TUBE MILLS–cold forming and welding

ENGINEERING YODER MANUFACTURING

Tips on barrel-finishing
MAKE TEST RUNS under actual production conditions before establishing operating procedure. Pre-determine exact size and amount of abrasive, ratio of parts to abrasive, amount of water, amount and type of cleaner, and barrel rpm for best results.
USE A CLEANER with a rust preventive agent when ferrous parts are tumbled. Dry and rust-proof parts immediately after barrel-finishing.
SEPARATE WORK FROM ABRASIVE with hand screens, when production is small. Use mechanized rubber-coated screens where production is large. Magnetic or non-magnetic separators are also available.
SCREEN TUMBLING ABRASIVE periodically, to maintain close grading. Grinding action within barrel eventually wears grains down. Periodic screening assures consistently uniform results.
ADD NEW ABRASIVE to the load periodically to compensate for loss of abrasive through gradual wear. This keeps ratio of abrasive and parts at best predetermined figure.

SPECIFY Norton ALUNDUM* Tumbling Abrasive for continuous cutting action — fast, positive cut — long, productive life. If you do not have barrel-finishing equipment, let Norton make test runs for you — at no obligation. Whether or not you have equipment, get your copy of Norton's new, informative, free booklet "Barrel-Finishing with ALUNDUM Tumbling Abrasive" — full of practical hints. Ask your Norton distributor or representative for Form 501. Or write us direct.

NORTON COMPANY, Worcester 6, Mass.
Distributors In All Principal Cities

NORTON
ABRASIVES
Making better products to make other products better

*Trade-Mark Reg. U.S. Pat. Off. and Foreign Countries

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-132

A head start

—in cutting costs with SUPER-FINISH Universal Drill Bushings

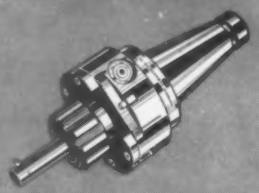
There's longer life in Universal Standard Drill Bushings because the bores are Super Finished. These Super Finished bores *reduce tool breakage and drill wear,* eliminate galling, have no sharp edges on which tools can hang up. Standard sizes available for immediate shipment. Universal warehouses at 1060 Broad St., Newark 2, N. J., and 5045 Sixth St., Kenosha, Wis., offer *prompt sectional delivery and information.* Cut production costs by specifying Universal Drill Bushings.

UNIVERSAL ENGINEERING COMPANY

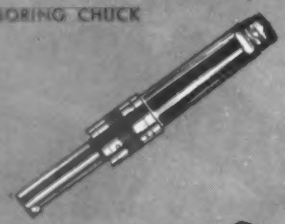
FRANKENMUTH 3, MICHIGAN

Facilities available for special hardened and ground precision parts made to customer specifications.

OTHER UNIVERSAL PRODUCTION TOOLS



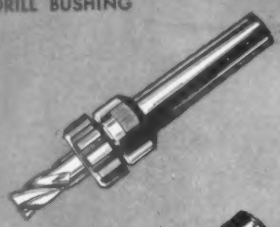
BORING CHUCK



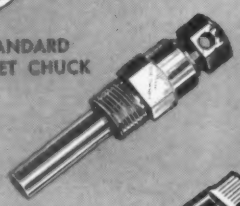
MIKRO-LOK BORING BAR

INDEX PLUNGER

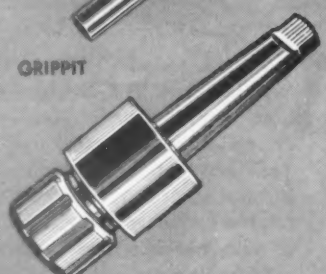
STANDARD DRILL BUSHING



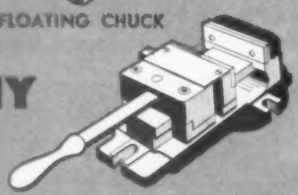
STANDARD COLLET CHUCK



GRIPPIT



FLOATING CHUCK



WEDGE-LOCK PRODUCTION VISE

in
reamer work
of
every kind
WAUKESHA
means . .

"MORE HOLES per grind!"

For a quarter of a century a closely-knit group of engineers and tool design specialists has concentrated its technical knowledge and skill in the production of superb, longer wearing, high precision *inserted* blade reamers and allied tools.

That's the reason WAUKESHA Blades *cut* with a clean, smooth, positive and effortless shear that saves in horsepower, increases production and, faithfully and regularly, gives you more holes per grind.

NEW!
Illustrated Catalog of
WAUKESHA TOOLS
Gives You Complete Specifications

It's good, sound judgment to find out more about WAUKESHA TOOLS—the wide range of standard units and Waukesha Tool Company's facilities to design and build cutting tools for your special needs. This new catalog just off the press is completely illustrated, descriptive, and planned for quick, handy reference. No charge. No obligation. Use the coupon or write, but send for it—today.

WAUKESHA TOOL CO. 1428 ARCADIAN AVE.
WAUKESHA, WISCONSIN

WAUKESHA TOOL CO.
Waukesha, Wis.
Please send your new Reamer Catalog to

NAME_____

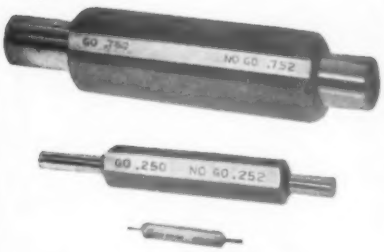
COMPANY_____ TITLE_____

STREET_____

CITY_____ STATE_____

USE READER SERVICE CARD; INDICATE A-10-134-1

SPECIFY *Van Keuren* WIRE TYPE PLUG GAGES
Carboloy
Chromium Plate
High Speed Steel
Alloy Tool Steel



Full 1⅞" and 2" length units may be cut to make 2, 3, or 4 gages . . . Always accurate. No rejections. Long life aluminum handles. Prompt delivery from a stock of 2 million wires.

Van Keuren Wire Type Gages are made to Class B accuracy +.00005" —.00000" on the Go units and ±.000025" on the No Go units. Closer or wider tolerances can be supplied if desired.

Catalog and Handbook No. 34
This 208 page volume represents 2 years of research sponsored by the Van Keuren Co.
It presents for the first time in history a simple and exact method of measuring screws and worms with wires.
It tells how to measure gears, splines and involute serrations. It is an accepted reference book for measuring problems and methods.
Copies free upon request.

THE *Van Keuren* CO., 174 Waltham St., Watertown, Mass.
32nd YEAR
Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Measuring Wires • Carboloy Plug Gages

USE READER SERVICE CARD; INDICATE A-10-134-2

Over 85% of the torque wrenches used in industry are

Sturtevant
TORQUE WRENCHES
Read by Sight, Sound or Feel

- Permanently Accurate
- Practically Indestructible
- Faster—Easier to use
- Automatic Release
- All Capacities

in inch ounces
...inch pounds
...foot pounds
(All sizes from 0-6000 ft. lbs.)

Every manufacturer, design and production man should have this valuable data. Sent upon request.

P.A. STURTEVANT CO.
ADDISON QUALITY ILLINOIS

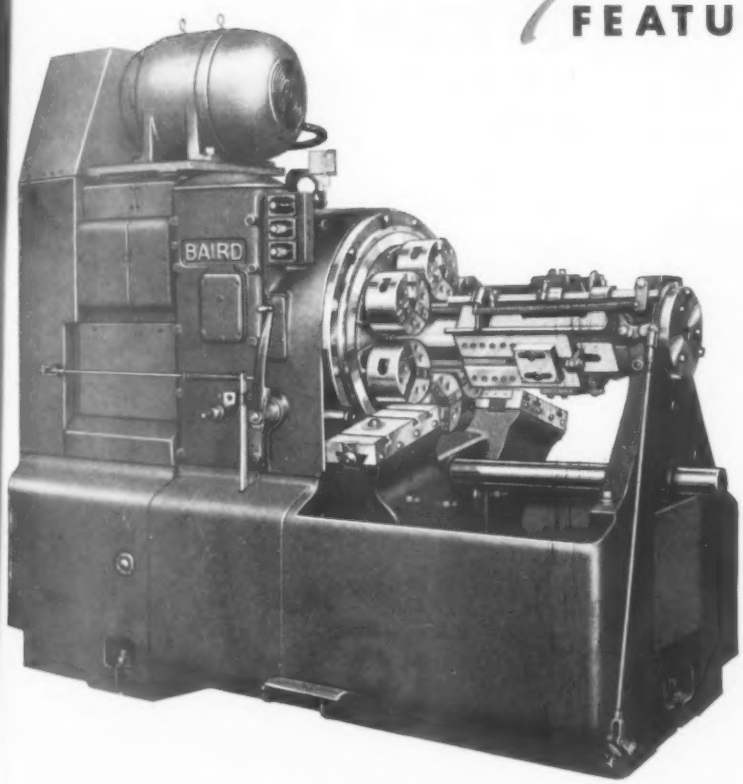
USE READER SERVICE CARD; INDICATE A-10-134-3

ASK BAIRD ABOUT IT!

HIGH PRODUCTION TOOLING

BAIRD *automatic* CHUCKERS *provide*

7 FEATURES . . THAT SPELL FAST, CLOSE-LIMIT PRODUCTION



- ACCESSIBILITY . . . to all tooling
- VERSATILITY . . . for numerous operations
- ACCURACY . . . maintained for long service life
- SAFETY . . . for machine, operator
- INDIVIDUAL TOOL SLIDES
- INDIVIDUAL Spindle Speeds
- AUTOMATIC CHUCKING . . . both hands free

The 7" chuck, 6 spindle, horizontal machine shown above has a production record that's hard to beat . . . in automotive, aircraft and other industries. It combines in a single automatic indexing cycle such operations as turning, facing, drilling, tapping, threading, grooving, chamfering . . . if desired . . . and performs with great accuracy at highly profitable speeds. All operations are automatic except loading and unloading . . . and both hands of the operator are free for this duty.

Automatic electrical and mechanical safety devices prevent damage when setting up, when loading is not within cycle time or when any motions are out of sequence.

For processing pistons, gears, pulleys, bushings, pump bodies, etc., the Baird 76 H Chucker will pay its way thru high production per man hour, reduced rejects, lower labor cost and increased dollar earnings per square foot of floor space. If you require such repetitive production, ask Baird engineers for practical recommendations.

the BAIRD MACHINE COMPANY
STRATFORD • CONNECTICUT

AUTOMATIC MACHINE TOOLS • AUTOMATIC WIRE & RIBBON METAL FORMING MACHINES • AUTOMATIC PRESSES • TUMBLING BARRELS

in
reamer work
of
every kind
WAUKESHA
means . .

"MORE HOLES per grind!"

For a quarter of a century a closely-knit group of engineers and tool design specialists has concentrated its technical knowledge and skill in the production of superb, longer wearing, high precision *inserted* blade reamers and allied tools.

That's the reason WAUKESHA Blades *cut* with a clean, smooth, positive and effortless shear that saves in horsepower, increases production and, faithfully and regularly, gives you more holes per grind.

NEW!
Illustrated Catalog of
WAUKESHA TOOLS
Gives You Complete Specifications

It's good, sound judgment to find out more about WAUKESHA TOOLS—the wide range of standard units and Waukesha Tool Company's facilities to design and build cutting tools for your special needs. This new catalog just off the press is completely illustrated, descriptive, and planned for quick, handy reference. No charge. No obligation. Use the coupon or write, but send for it—today.

WAUKESHA TOOL CO. 1428 ARCADIAN AVE.
WAUKESHA, WISCONSIN

WAUKESHA TOOL CO.
Waukesha, Wis.
Please send your new Reamer Catalog to

NAME_____

COMPANY_____ TITLE_____

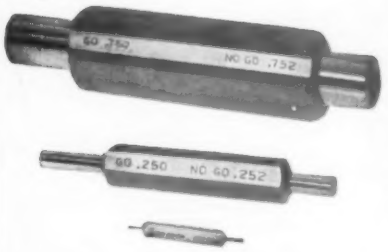
STREET_____

CITY_____ STATE_____

USE READER SERVICE CARD; INDICATE A-10-134-1

SPECIFY *Van Keuren*

WIRE TYPE PLUG GAGES
Carboloy
Chromium Plate
High Speed Steel
Alloy Tool Steel
Full 1⅞" and 2" length units may be cut to make 2, 3, or 4 gages . . . Always accurate. No rejections. Long life aluminum handles. Prompt delivery from a stock of 2 million wires.



Van Keuren Wire Type Gages are made to Class B accuracy +.00005" —.00000" on the Go units and ±.000025" on the No Go units. Closer or wider tolerances can be supplied if desired.

Catalog and Handbook No. 34
This 208 page volume represents 2 years of research sponsored by the Van Keuren Co. It presents for the first time in history a simple and exact method of measuring screws and worms with wires.
It tells how to measure gears, splines and involute serrations. It is an accepted reference book for measuring problems and methods.
Copies free upon request.

THE *Van Keuren* CO., 174 Waltham St., Watertown, Mass.
32nd YEAR
Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Measuring Wires • Carboloy Plug Gages.

USE READER SERVICE CARD; INDICATE A-10-134-2

Over 85% of the torque wrenches used in industry are

Sturtevant
TORQUE WRENCHES
Read by Sight, Sound or Feel

- Permanently Accurate
- Practically Indestructible
- Faster—Easier to use
- Automatic Release
- All Capacities

in inch ounces
...inch pounds
...foot pounds
(All sizes from 0-6000 ft. lbs.)

Every manufacturer, design and production man should have this valuable data. Sent upon request.

P.A. *Sturtevant* CO
ADDISON QUALITY ILLINOIS

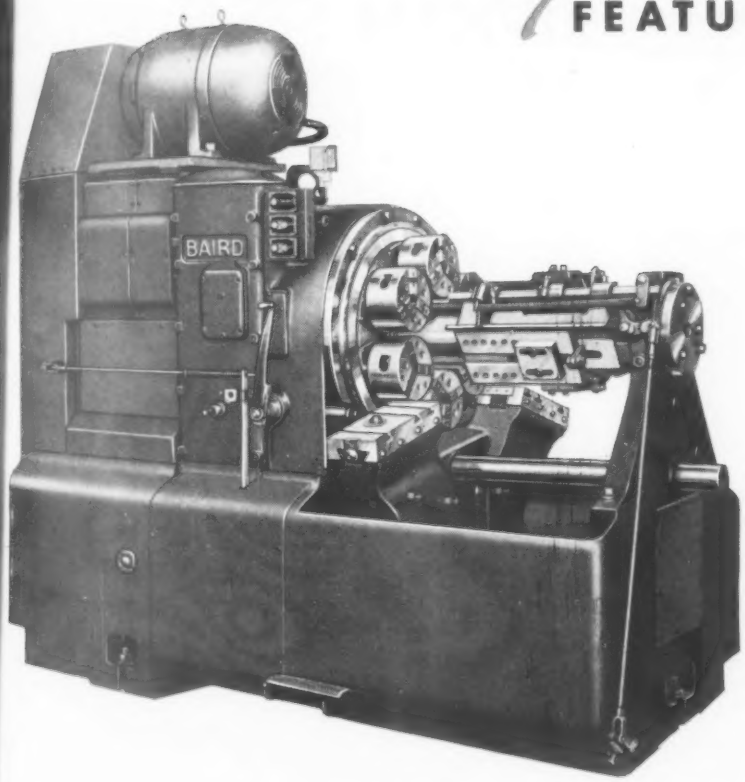
USE READER SERVICE CARD; INDICATE A-10-134-3

ASK **BAIRD** ABOUT IT!

HIGH PRODUCTION TOOLING

BAIRD *automatic* CHUCKERS *provide*

7 FEATURES . . THAT SPELL FAST, CLOSE-LIMIT PRODUCTION



- ACCESSIBILITY . . . to all tooling
- VERSATILITY . . . for numerous operations
- ACCURACY . . . maintained for long service life
- SAFETY . . . for machine, operator
- INDIVIDUAL TOOL SLIDES
- INDIVIDUAL Spindle Speeds
- AUTOMATIC CHUCKING . . . both hands free

The 7" chuck, 6 spindle, horizontal machine shown above has a production record that's hard to beat . . . in automotive, aircraft and other industries. It combines in a single automatic indexing cycle such operations as turning, facing, drilling, tapping, threading, grooving, chamfering . . . if desired . . . and performs with great accuracy at highly profitable speeds. All operations are automatic except loading and unloading . . . and both hands of the operator are free for this duty.

Automatic electrical and mechanical safety devices prevent damage when setting up, when loading is not within cycle time or when any motions are out of sequence.

For processing pistons, gears, pulleys, bushings, pump bodies, etc., the Baird 76 H Chucker will pay its way thru high production per man hour, reduced rejects, lower labor cost and increased dollar earnings per square foot of floor space. If you require such repetitive production, ask Baird engineers for practical recommendations.

the **BAIRD MACHINE COMPANY**
STRATFORD • CONNECTICUT

AUTOMATIC MACHINE TOOLS • AUTOMATIC WIRE & RIBBON METAL FORMING MACHINES • AUTOMATIC PRESSES • TUMBLING BARRELS

for Unmatched Values always specify

ACE

FINER DRILL BUSHINGS

Three-fourths Million Standard and Special Size Inventory . . . Highest Quality Steels . . . Perfect Design and Engineering . . . Faster, Reliable Service.

Affiliate member A.S.T.E. Chap. 27

ultra UP precision
THAT EXTRA ACE VALUE

ACE DRILL BUSHING CO.
5401 FOUNTAIN AVENUE LOS ANGELES 27
HOllywood 9-8253

USE READER SERVICE CARD; INDICATE A-10-136-1

DRILL HARDENED STEEL WITHOUT ANNEALING WITH "HI-ROCKWELL" DRILLS

Every toolroom needs Champion "Hi-Rockwell" drills. These tools drill precision holes in steels testing C-40 to C-68 Rockwell quickly and without annealing. Ideal for reworking tools and dies, they actually cut a curled chip! *THEY CUT!!!*

Some sales territories open.

Available in standard sizes—from stock of:

CHAMPION TOOL CO.
24060 Orchard Lake Rd. Farmington, Michigan

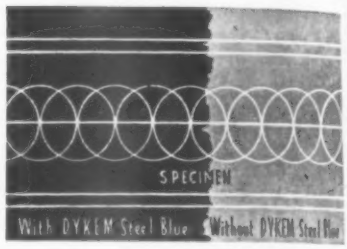
We also are the manufacturers of the Nu-Mikro piston grooving tools.

USE READER SERVICE CARD; INDICATE A-10-136-3

DYKEM STEEL BLUE

STOPS LOSSES

making dies & templates



Simply brush on right at the bench; ready for the layout in a few minutes. The dark blue background makes the scribed layout show up in sharp relief and at the same time prevents metal glare. Increases efficiency and accuracy.

Write for full information

THE DYKEM COMPANY, 2303D North 11th St., St. Louis 6, Mo.

USE READER SERVICE CARD; INDICATE A-10-136-4

Made to your Order...

FULLER

Cutting Tools

SPECIAL, HIGH-PRECISION
HIGH-SPEED STEEL & CARBIDE TIPPED

FULLER TOOL CO.
4000 WEST ELEVEN MILE RD.
BERKLEY, MICH. LINCOLN 2-5600

USE READER SERVICE CARD; INDICATE A-10-136-2

Walker Magnetic Chucks Hold Everything

For sixty years, Walker has specialized in the designing and production of magnetic holding devices. Today, Walker produces a complete line of magnetic chucks and designs special chucks to meet unusual holding problems.

●

Standard Electro and Permanent Magnetic Chucks . . . Vacuum Chucks . . . Special Applications for various holding problems . . . Demagnetizers . . . Magnetic clutches.

O. S. WALKER CO. Inc.
WORCESTER 6, MASSACHUSETTS
Original Designers - Builders of Magnetic Chucks

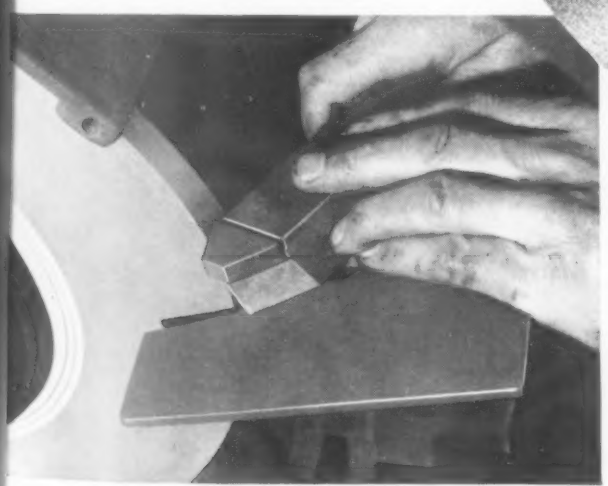
USE READER SERVICE CARD; INDICATE A-10-136-5

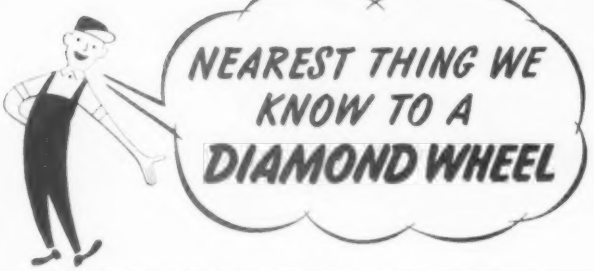
NEW "XL" BOND FOR CARBIDE TOOL AND CUTTER GRINDING

Assures Efficient Performance at Far Lower Cost!

It's really big news . . . this new "XL" Bond! "XL" is the name of Chicago Wheel's remarkable new line of silicon carbide vitrified grinding wheels . . . especially made for carbide tool and cutter grinding.

"XL" wheels come in the most popular tool and cutter sizes and steel backs. They're designed for efficient, economical, rough and finish grinding . . . offhand or precision automatic. And they're already proving themselves on the job, helping to keep the nation's carbide tools and cutters in first-class shape for the mobilization program. "XL" is unexcelled . . . and another 1st for Chicago Wheel!





WRITE NOW!
Send for literature and engineering report on the new "XL" Bond Silicon Carbide Grinding Wheels.

CHICAGO WHEEL & Mfg. Co.
1101 West Monroe Street, Chicago 7, Illinois

OFFICES IN PRINCIPAL INDUSTRIAL CENTERS

CHICAGO WHEEL & MFG. CO. Dept. T E
1101 West Monroe Street, Chicago 7, Illinois

Name .....

Firm .....

Address .....

City ..... Zone ..... State .....

LET'S GET IT STRAIGHT!

The "DIMENSIONAIR" Air Gage —

IS calibrated accurately over its entire range

IS set accurately with only *one* master

HAS a range of .003" with 2500 to 1 magnification

HAS much longer plug wear

HAS greater plug clearance so that the same plug can be used on *both* rough and finished dimension

REMAINS *stable* for long periods of time

Yes, let's get it straight, the Dimensionair uses its own operating principle and new mechanical devices which do away with the limitations common to previous types of air gages.

ACTUAL SIZE
9" x 7⅜" x 8¼"
WEIGHT 17¾ LBS.

FEDERAL DIMENSIONAIR
PROVES ITSELF

Why not find out to your own satisfaction what the Federal Dimensionair will do for you! Put it to work — discover how the exceptional measuring range of .003" lets you gage irregular shaped and tapered holes. Oil or coolants won't affect the Dimensionair: grit and dirt won't clog it: rough handling won't harm it.

Find out how the Dimensionair can do all this and more — ask our nearest representative to show you the Federal way to better, more positive air gaging, or write to us for complete information and prices. FEDERAL PRODUCTS CORPORATION, 1910 Eddy St., Providence 1, R. I.

FEDERAL

Largest manufacturer of indicating type gages . . . exclusively.

USE READER SERVICE CARD: INDICATE A-10-138-1

Acme Offers
Complete Facilities for

PRECISION GRINDING

FAST SERVICE... LOW COST

- INTERNAL
- EXTERNAL
- CRUSH FORM
- CENTERLESS
- TWIN DISC
- SURFACE
- THREAD

Acme is equipped to handle all types of precision grinding. Expert craftsmen, using newest methods and modern equipment, will do the job for you faster, better, more economically. Acme also offers a flat lapping service that can finish surfaces to within millionths. Write for details.

Acme Industrial Company
Makers of Standardized Jig & Fixture Bushings
200 N. LAFLIN STREET • CHICAGO 7, ILLINOIS

THE SERVICE SHOP TO INDUSTRY FOR MORE THAN 25 YEARS

USE READER SERVICE CARD: INDICATE A-10-138-2

For quick, accurate, on-the-spot hardness testing, reading directly in the Rockwell scales.

Ames
PORTABLE
HARDNESS TESTER

Flat and round bars, sheets, tubing and wire are tested on the spot without cutting off specimens. Punches, dies, cutters, saws and odd-shaped pieces are tested before and after heat treating. Used by metallurgists, inspectors and heat-treaters. Sizes for work 1" to 6" round and flat. Send for circular.

"See Ames Tester demonstrated at Metals Show (Detroit) Booth A152"

AMES PRECISION MACHINE WORKS
Makers of Precision Bench Lathes & Milling Machines
WALTHAM 54, MASSACHUSETTS

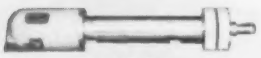
USE READER SERVICE CARD: INDICATE A-10-138-3

For

PRECISION SPINDLES...

Specify

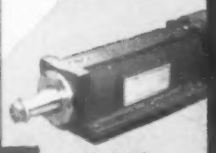
P-5101

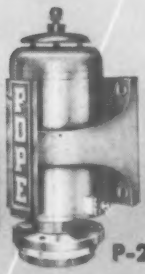

P-1766

P-2652

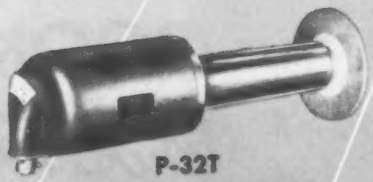
P-2641

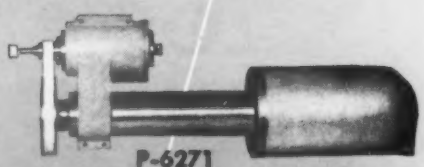
POPE

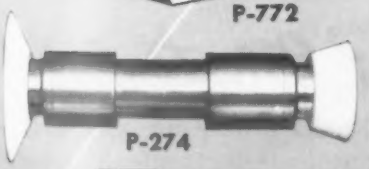

P-666

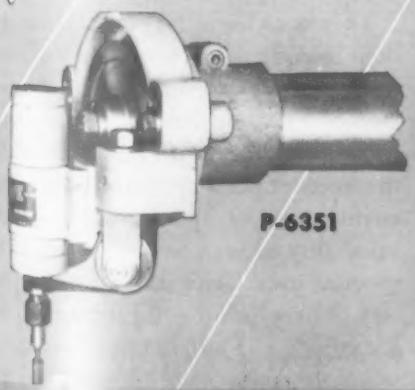

P-2500

P-772


P-32T


P-6271


P-274


P-6351

Whatever the type or size of Spindle you need, let POPE be your spindle department.
It pays off in terms of finer finishes and continuous production of accurate parts.

The POPE System of sealed-in lubrication assures permanent bearing lubrication and long life.

Let us have your specifications so we can send you price and delivery estimates on the one best spindle for your job.

No. 79

POPE

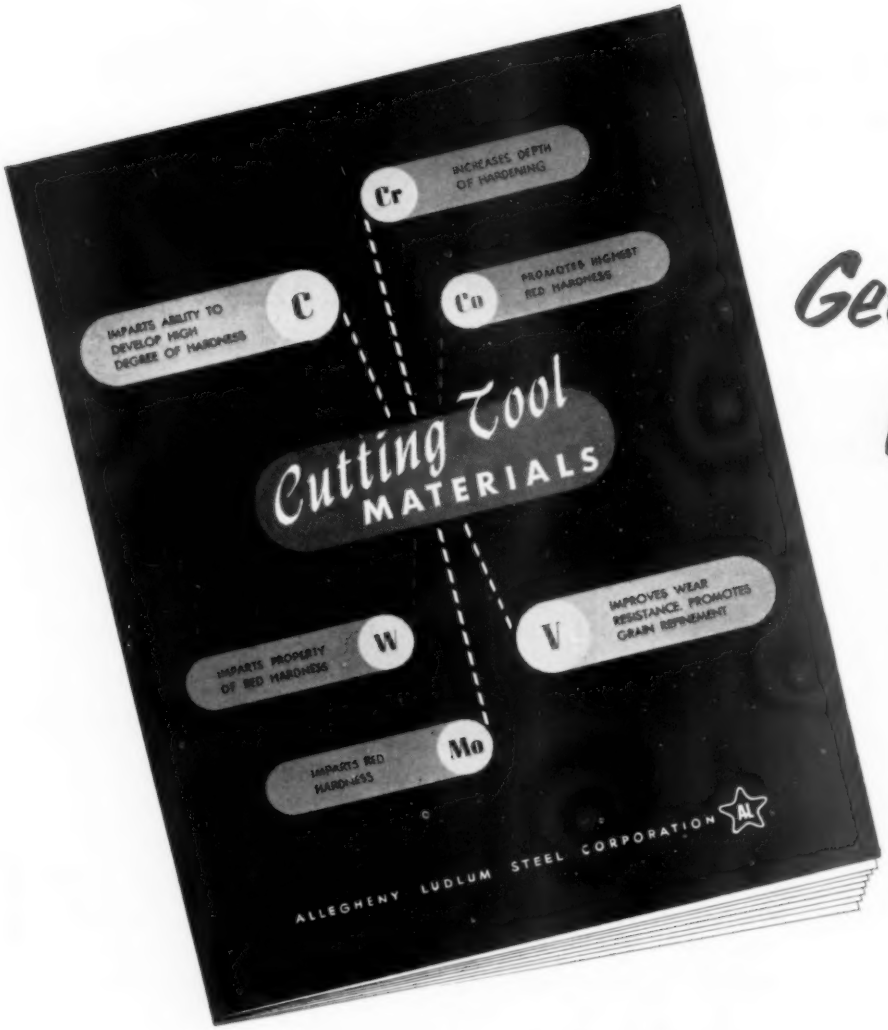
TRADE MARK REG. U.S. PAT. OFF.

POPE MACHINERY CORPORATION

ESTABLISHED 1920

261 RIVER STREET • HAVERHILL, MASSACHUSETTS

BUILDERS OF PRECISION SPINDLES



Get your copy...

WRITE FOR IT TODAY!

LOOK in this BOOKLET

when you're *puzzled about Tool Materials!*

A-L OFFERS YOU
Complete Service for Modern Tooling

By "complete" is meant that Allegheny Ludlum produces the full range of modern cutting tool materials, hence is in position to know and recommend the type best suited for any stated purpose. Unbiased content makes the 8½" x 11" booklet, shown, all the more valuable. Specify its title, "Cutting Tool Materials."

ADDRESS DEPT. TE-22

You should have a personal copy of this 36-page booklet close at hand, if you are continually running into new cutting problems. Use it as a guide to quick answers to scores of possible questions such as:

"Should we use *Carbide* on this job? What grade?" . . . or, "How about tooling up with *Cast Alloy* for that other run?" . . . or, "Can we cut this extra-tough stock fast enough with our usual grade of *High Speed Steel?*"

This booklet in no way replaces, but does supplement, what you can learn by practical experience or what you can gain by calling in an A-L tool engineer. In compact form and quite impartially, the booklet presents the basic facts that enable you to speedily compare the suitability of various tool materials for specific uses. *Send today for your free copy.* There is no obligation involved.

● *Allegheny Ludlum Steel Corporation, Henry W. Oliver Bldg., Pittsburgh 22, Pa.*

For complete **MODERN** Tooling, call

Allegheny Ludlum

W&D 3703

AL
FINE TOOL STEELS SINCE 1854

CARD
Machine Screw
TAPS

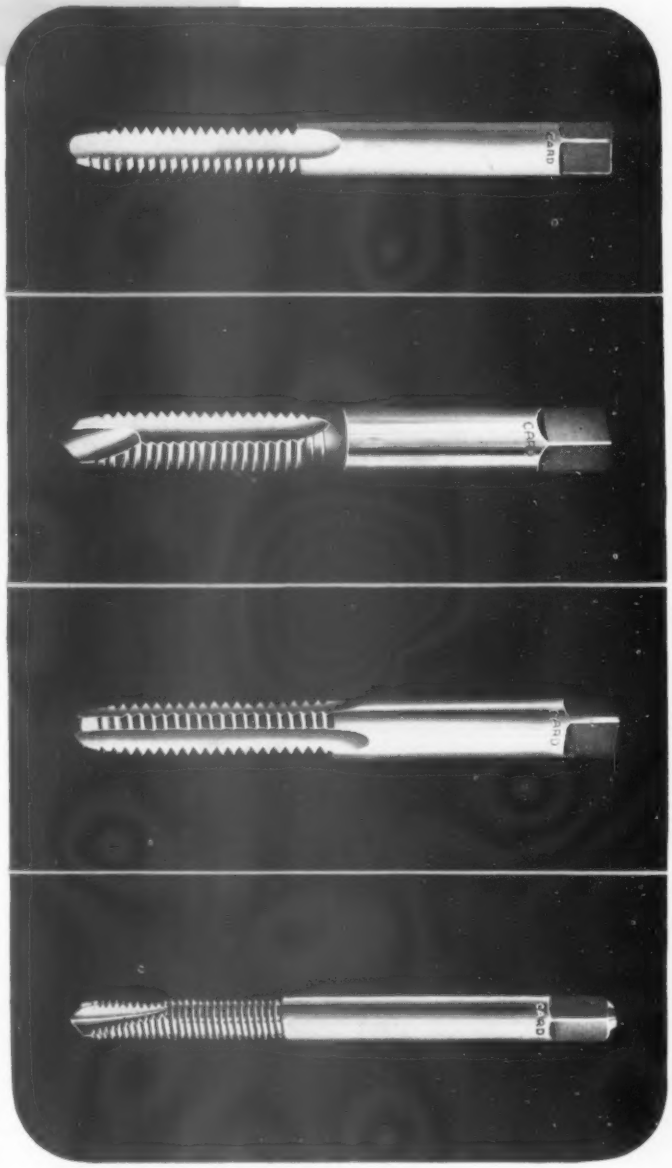
Card Machine Screw Taps are available in carbon steel cut thread and high speed steel cut thread or ground thread.

Double-Checked to give you Double protection at ordinary cost

If anyone asked you where taps get their final inspection, you'd probably answer: "At the factory where they're made." In the case of ordinary taps you'd be right. But you'd be dead wrong about Card Taps. Because at times and places unknown to us, the Pittsburgh Testing Laboratory buys Card Taps on the open market, tests them thoroughly and certifies the results.

That means double the protection you get with run-of-the-mill taps — *yet Card Certified* Taps are right at ordinary price levels!*

You can always count on prompt, helpful service from your nearby Card Distributor. Contact him for Card Machine Screw Taps and other Card Taps and Cutting Tools.



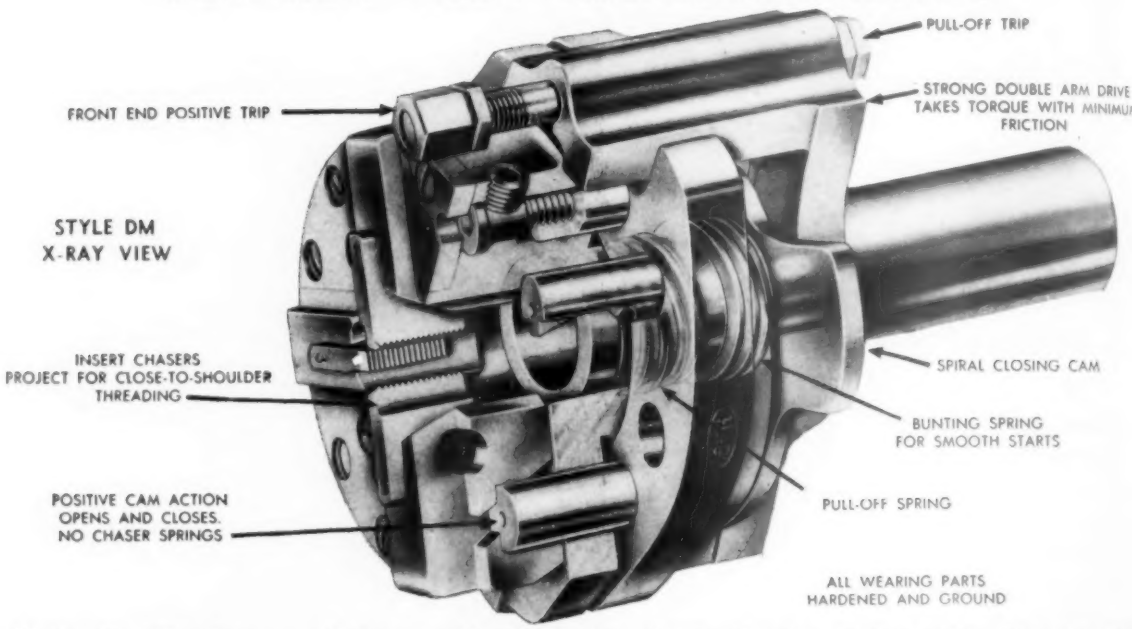
TAPS
The Certified Cutting Tools*
*by the Pittsburgh Testing Laboratory
Also makers of DIES • SCREW PLATES
DIE STOCKS • TAP WRENCHES

S. W. CARD
MANUFACTURING CO.
Mansfield, Massachusetts
DIVISION OF UNION TWIST DRILL COMPANY

H&G Insert Chaser DIE HEADS

SIMPLE, POSITIVE, CAM-ACTION

FOR NEW HIGH THREADING SPEEDS


PULL-OFF TRIP
STRONG DOUBLE ARM DRIVE TAKES TORQUE WITH MINIMUM FRICTION
FRONT END POSITIVE TRIP
STYLE DM
X-RAY VIEW
INSERT CHASERS PROJECT FOR CLOSE-TO-SHOULDER THREADING
SPIRAL CLOSING CAM
BUNTING SPRING FOR SMOOTH STARTS
POSITIVE CAM ACTION OPENS AND CLOSES. NO CHASER SPRINGS
PULL-OFF SPRING
ALL WEARING PARTS HARDENED AND GROUND

The Majority Producers of Screw Machine Products Prefer H & G Die Heads Because

(1) Positive tripping opens chasers at exact length of thread.

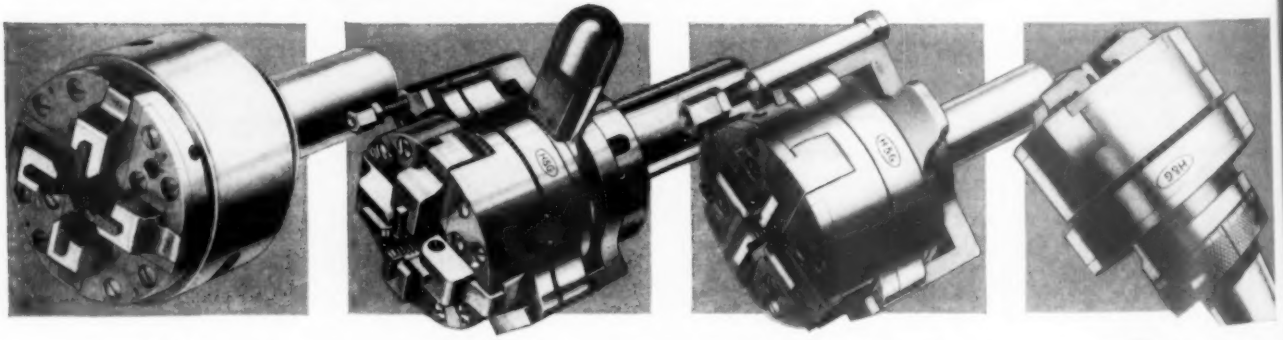
(2) Simple way of changing chasers. Operators do it without aid of set-up man.

(3) The same set of chasers can be used in many sizes and styles. This, together with low cost of chasers, simplifies and reduces inventory.

(4) High quality of threads, smooth finish and accuracy to Class III fits.

(5) Difference in low cost insert chasers and conventional types . . . accounts for large part of the profit on highly competitive jobs.

SIZES AND STYLES FOR ALL TYPES OF MACHINES ON WHICH THREADS ARE CUT



STYLE MM
For threading on multiple spindle automatics, viz.: Gridley, National Acme, New Britain, Cone, Greenlee, Davenport; any machine that ROTATES the die head—chucking machines, bolt threaders, drill presses, etc.

STYLE DMS
For cutting threads on turret lathes, hand screw machines and similar type machines which ROTATE the workpiece, holding the die head STATIONARY.

STYLE DM
Especially designed for cutting threads at new high speeds on Brown and Sharpe automatics, Cleveland single spindles, etc. Positive, instant tripping and long-run dependability at high indexing speeds.

STYLE TM
For superior quality taper-cut pipe threads. Chasers recede at a definite rate. Die head opens instantly when exact length of thread is cut, leaving no tell-tale marks on the threads.

Check and Mail For Literature

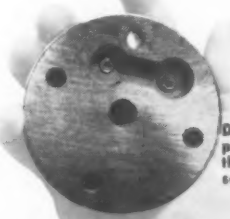
☐ "SELECTING PROPER DIE HEAD FOR THE JOB"
☐ STYLE MM ☐ STYLE DMS ☐ STYLE DM ☐ STYLE TM

Manufactured by THE EASTERN MACHINE SCREW CORPORATION
24-44 BARCLAY STREET, NEW HAVEN, CONN.
GENERAL PURPOSE DIE HEADS. THREADED RODS. THREADING MACHINES.

More Production—*Yes...*

Better Finish—*Too...*

with BESLY GRINDERS!



Diameter of end plates is 3⅛"x.361" thick — practically a solid area.

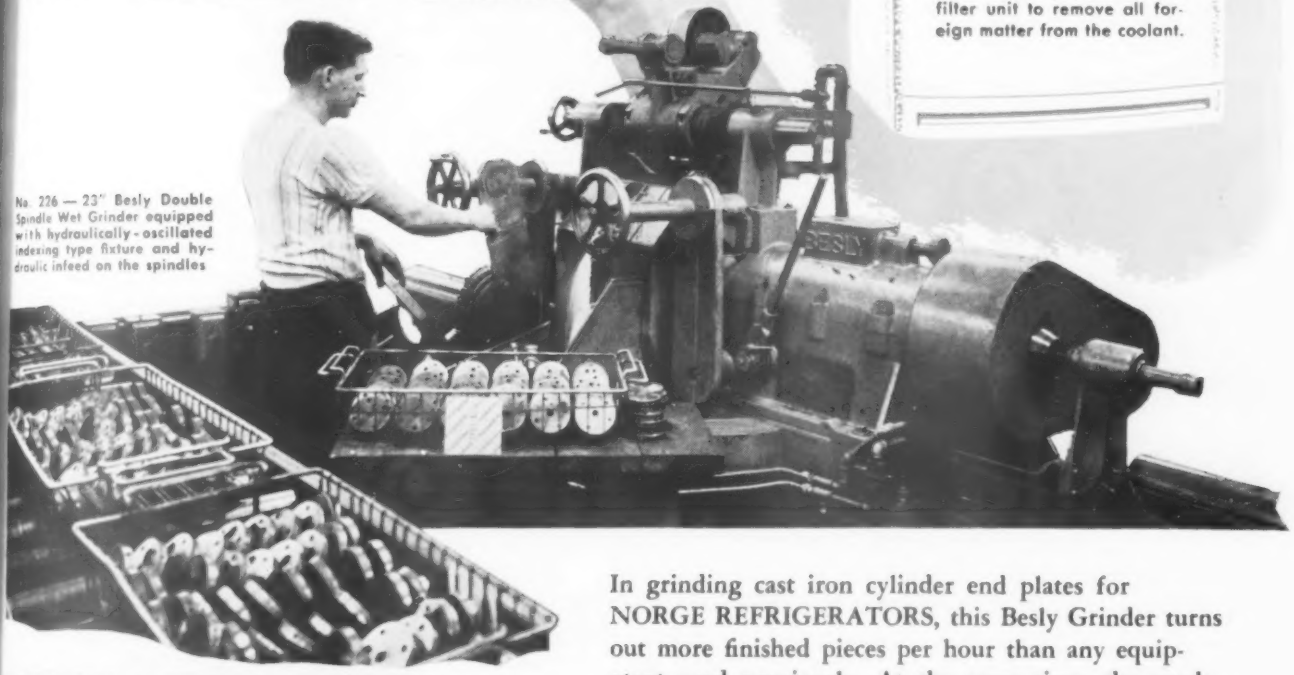
Case Facts on This Grinding Operation

Work is held to .00005" for flatness . . . and parallel to within .0005" — with a surface finish of 10 micro-inches or better.

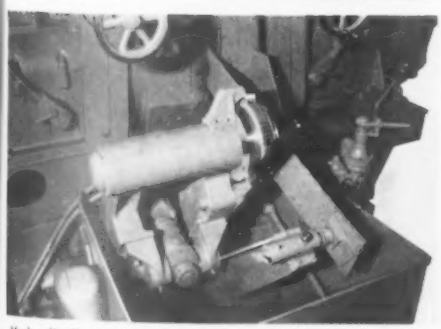
Uniform flatness of work as it comes from the grinder eliminates necessity for a subsequent lapping operation.

Parts come to the grinder with .002-.003" overall stock for final grind. Production is 180 finished pieces per hour — a total of 360 surfaces.

Grinder is equipped with a filter unit to remove all foreign matter from the coolant.



No. 226 — 23" Besly Double Spindle Wet Grinder equipped with hydraulically-oscillated indexing type fixture and hydraulic infeed on the spindles



Hydraulically-oscillated indexing-type fixture — with hydraulic infeed on the spindles — is adjustable to change rate of oscillations.

In grinding cast iron cylinder end plates for NORGE REFRIGERATORS, this Besly Grinder turns out more finished pieces per hour than any equipment used previously. At the same time, the work is finished so accurately that a subsequent lapping operation has been eliminated. Such outstanding performance pays off in lower production costs for an *improved product.*

Whatever your product — if precision-ground surfaces are essential — Besly may be able to point out how increased production can be achieved at lower unit cost. Consultation with a Besly engineer does not obligate you.

BESLY-TITAN WHEELS! Ask for a copy of this new Besly-Titan booklet of abrasive wheels and discs—a valuable source of information on modern grinding abrasives—up-to-date—authoritative. Write for your copy today!

WRITE TODAY!

BESLY

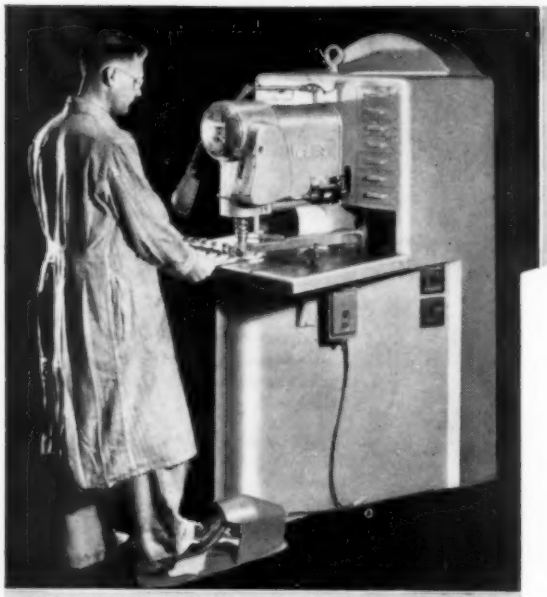
TAPS — the world's most accurate tap.

TWIST DRILLS AND REAMERS —Complete line for every need.

BESLY-TITAN ABRASIVE WHEELS AND DISCS— individually formulated for your job.

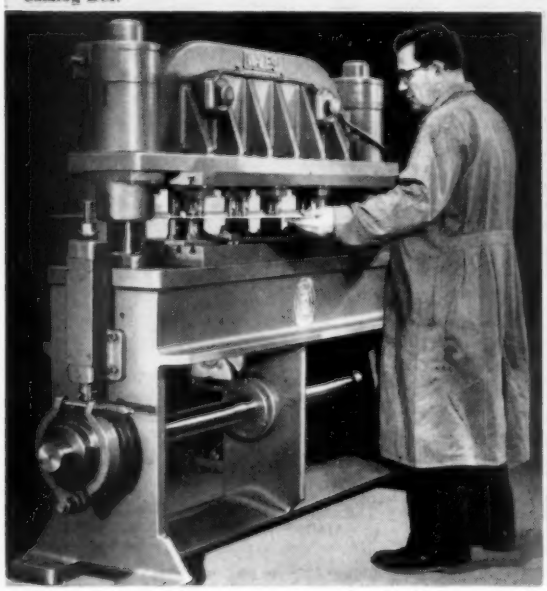
GRINDERS that reduce costs on every type of surface grinding

CHARLES H. BESLY & COMPANY • FACTORY: BELOIT, WISCONSIN

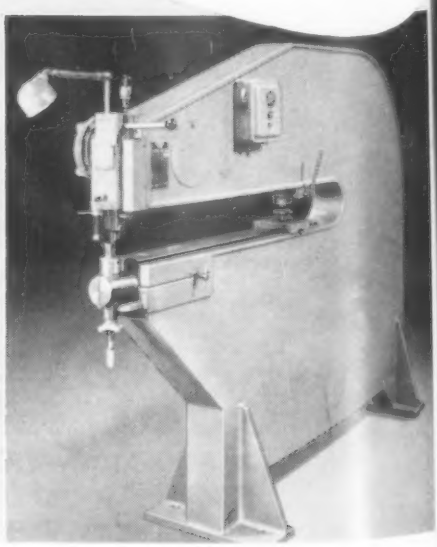


WALES SHEET METAL FABRICATOR provides rapid interchangeability for punching and notching. Work from blue prints or operation sheets. *No Templets Required.* Write for Catalog 10-A.

WALES DRILLING MACHINE is specially designed to meet the exacting requirements of locating, drilling and reaming holes in material of practically any length and up to 36" wide. Write for Catalog DM.



WALES TWIN COLUMN PRESS features simplicity of design that fulfills the engineering axiom-"building it simple builds it better". In many cases, this press eliminates the necessity of a die set. Write for Catalog TC.



TRU-EDGE CONTOUR SHEAR cuts and trims irregular shapes and circles and also beads, rigidizes, forms and flanges. Ideal for accurate, short run work eliminating prohibitive die costs. *Send for Catalog TS.*

WHY IT PAYS TO STANDARDIZE ON

WALES

SHEET METAL EQUIPMENT

● In practically every sheet metal fabricating plant or department there is a need for Wales Machinery and Equipment. Standardizing on this versatile line assures the exact type for various operations.

For example, hole punching and notching operations may be performed on either the Wales Fabricator or on the Wales Twin Column Press with Wales Hole Punching and Notching Units. Depending on the number of parts and the size and shape of the work, one piece of Wales Equipment is more efficient and economical than the other.

To fully determine which Wales Equipment is most applicable to a particular type of work, call on Wales Engineers who have years of experience in the most economical way to fabricate sheet metal parts. Yes, make it standard practice to call on Wales Engineers FIRST for their valuable suggestions.

WALES-STRIPPIT CORPORATION
GEORGE F. WALES, *Chairman*
393 PAYNE AVE., NORTH TONAWANDA, N. Y.
(Between Buffalo and Niagara Falls)
WALES-STRIPPIT OF CANADA LTD., HAMILTON, ONTARIO

Specialists in Punching and Notching Equipment

When it comes to production- come to Hartford Special

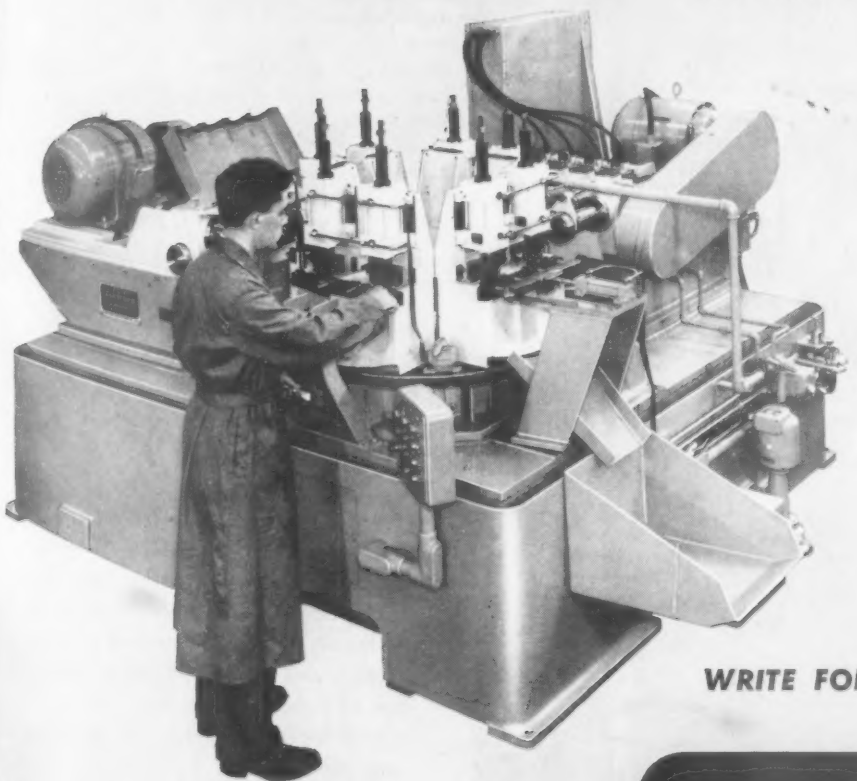
This part has

a production rate of 1280 PCS. PER HOUR

hollow milled from square section and threaded

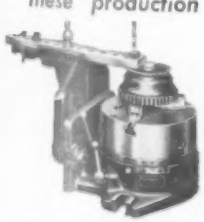
on this HARTFORD SPECIAL

AUTOMATIC DRILLING & TAPPING MACHINE

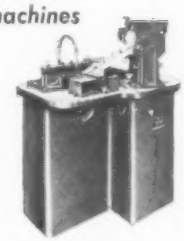


WRITE FOR BULLETIN NOW!

Hartford Special also makes these production machines



SUPER-SPACERS



Automatic THREAD ROLLERS

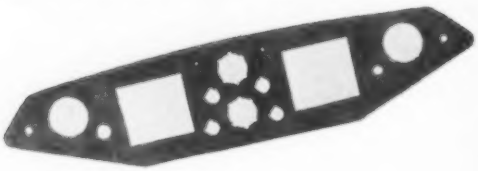
DIE POLISHERS

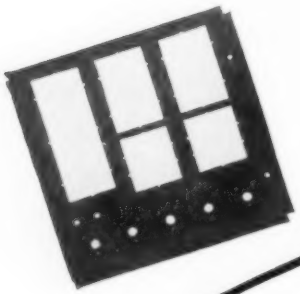
HARTFORD *Special*

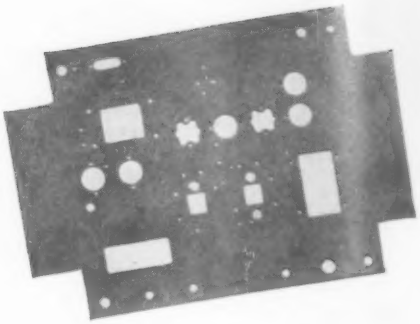
THE HARTFORD SPECIAL MACHINERY CO.
HARTFORD 12, CONNECTICUT

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-145

if you produce...







SEE WIEDEMANN

Bulletin 241 describes the most efficient method of producing chassis and similar work in short runs and semi-production runs. Repeat runs of 5 to 1,500 pieces and single runs of 50 to 5,000 pieces are economically produced on the Wiedemann RA-41P. Write today for bulletin 241.

THE WIEDEMANN METHOD permits you to: (1) Keep up with engineering changes without materially affecting production schedule; (2) Keep tool inventory low; (3) Produce quantities in accordance with sales requirements; (4) Produce accurate work with inexpensive tools.

"THE WIEDEMANN METHOD" through the elimination of expensive punch and die set-up and work location methods, provides an efficient means of piercing single pieces, and semi-production runs, regardless of repeat frequency.

Machines available for piercing sheet and plate up to ½" thick, up to 120" wide x 200" long.

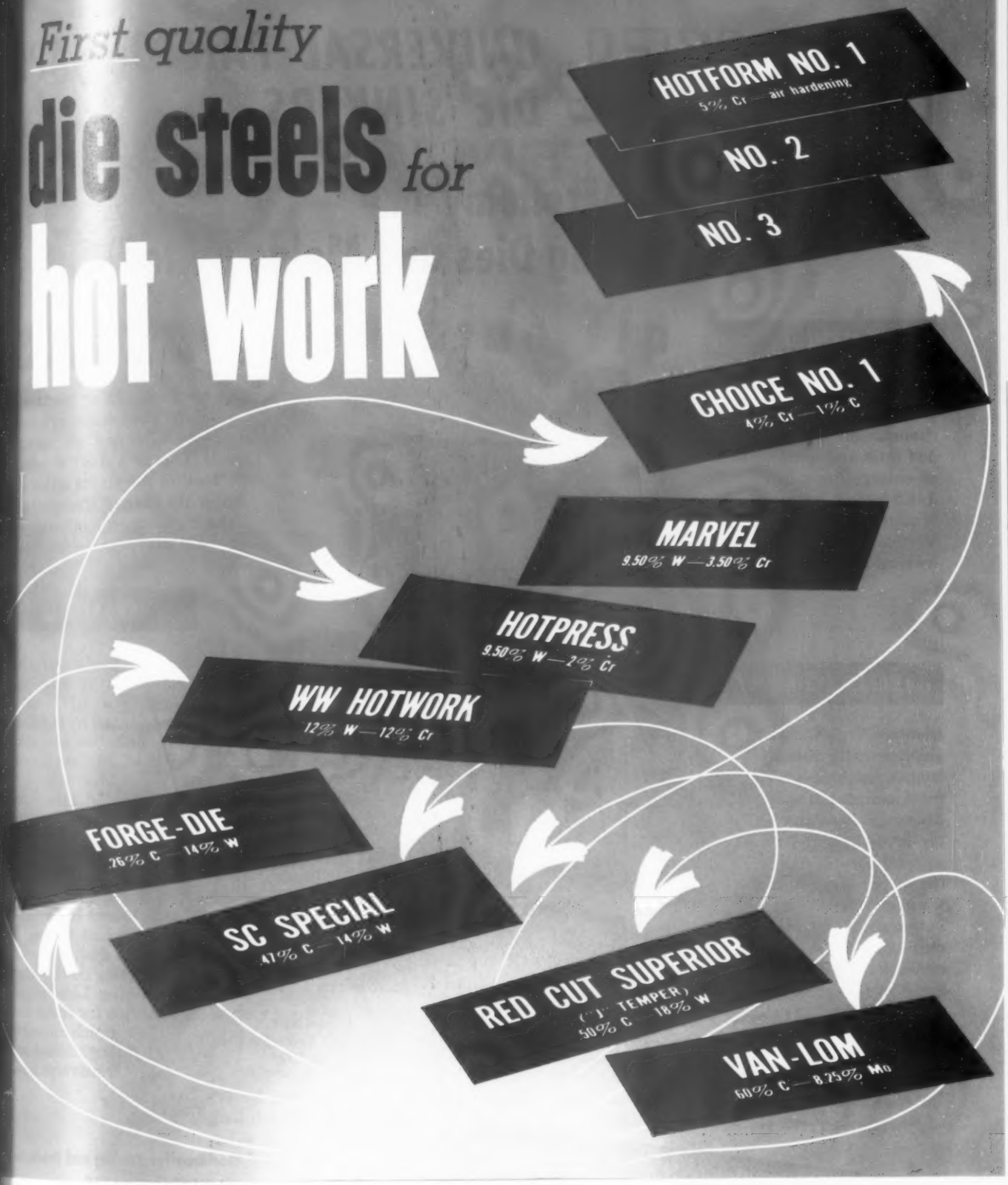
Wiedemann
TURRET PUNCH PRESSES

WIEDEMANN MACHINE COMPANY

4245 WISSAHICKON AVE., PHILADELPHIA 32, PENNSYLVANIA

First quality

die steels *for* hot work



These Die Steels are designed to meet your every hot work requirement. They are made to exacting standards and inspected by magnaflux, reflectoscope and deep etching to insure First Quality Steels. All grades are available in bars and forgings.

Our sales representatives will be glad to work with you in selecting the best grade for your particular job and in the correct heat treatment for maximum performance.

Booklet "Die Steels for Hot Work" sent on request.

Vanadium-Alloys
STEEL COMPANY
LATROBE, PENNA.

COLONIAL STEEL DIVISION • ANCHOR DRAWN STEEL CO.

DECKEL UNIVERSAL PANTOGRAPH DIE SINKERS

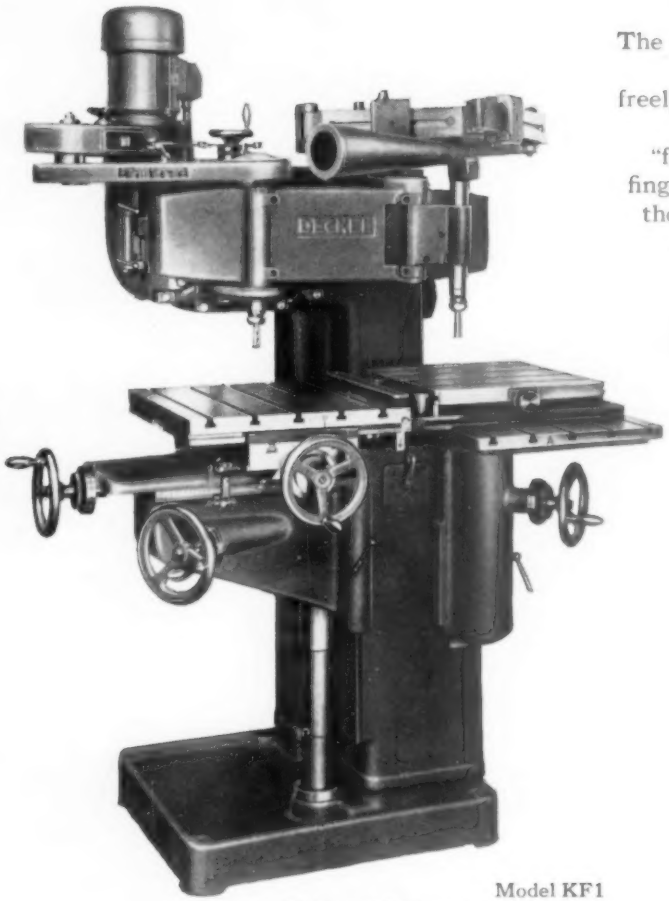
for Greater Economy in Producing Dies and Molds up to 1100 lbs.

LATITUDE

The pantograph system permits two and three dimensional milling at 1:1 ratio and reductions or enlargements from 1:1.5 to 1:4. The machine is converted to a plain Vertical Miller by simply locking spindle head.

GREATER ECONOMY

Masters or patterns of geometrically defined shapes can be made from sample parts or drawings. Dies are produced in a single set-up by using either the incremental horizontal feed or the automatic depth feed method. This eliminates extensive hand finishing operations.



Model KF1
Universal Pantograph Die Sinker
with optical contacting device for rough milling.

GREATER ACCURACY

The parallel guiding mechanism and the pantograph move freely on roller and ball bearings. This provides the delicate "feel" of the cutter action and finger-tip control, that produces the high dimensional accuracy and excellent surface finish.

VERSATILITY

The usefulness of the KF1 for machining at a 1:1 ratio is broadened by the many accessories available. Rough Milling Spindle holds cutters up to 1½" diameter and increases cutting capacity. Four position spindle head bracket for rough milling and extension of cutting area. Circular attachment for forming cylindrical, tapered or spherical shapes. Optical contacting device when rough milling. Line milling device for rough and finish milling in longitudinal and transverse lines.

SEE THESE MACHINES IN OPERATION AT COSA'S NEW YORK SHOW ROOM OR SEND FOR DESCRIPTIVE LITERATURE.

Other Deckel Machines for Tooling and Production

UNIVERSAL MILLERS
2 DIMENSIONAL ENGRAVERS
3 DIMENSIONAL ENGRAVERS
UNIVERSAL TOOL & CUTTER GRINDERS

COSA CORPORATION

405 Lexington Ave., New York 17

Your source for all Precision Machine Tools— from Small Bench Lathes to Large Boring Mills

IN DETROIT AREA contact DETROIT-COSA CORPORATION, 16923 James Couzens Highway, Detroit 35, Mich.

MAKEPEACE
TRI-METAL SHIMS
for
Carbide Tip Brazing

Four years ago, Makepeace introduced their laminated Tri-Metal shim strip as a labor-and-money-saving method of tipping carbide cutting tools. This combination of cushion metal centered between two layers of brazing solder is now widely used in industry as the ideal method for bonding carbide tips, in all shapes and sizes.

Along with our regular production of flat stock, we now offer as an additional service . . . the stocking of copper-centered shims in an assortment of twenty-six of the most called-for sizes. These are available for prompt shipment in your choice of .020 or .025 in thickness.

Write for prices on strip in coils or individual sizes and assortments. Our staff of thoroughly experienced engineers, metallurgists and consultants is at your service at all times to assist in working out your particular problems.

D. E. MAKEPEACE COMPANY

Laminated and Solid Precious Metals for Industrial Use • Fabricated Parts and Assemblies • Bar Contact Material • Precious Metal Solders

MAIN OFFICE AND PLANT, ATTLEBORO, MASSACHUSETTS

SALES OFFICES

NEW YORK CHICAGO LOS ANGELES

Boyar-Schultz tools . . . your chief aid to FULL screw machine PRODUCTION

15 screw machine tools . . . an ever growing line *for the toughest jobs!*

You are fully aware that your screw machines are built to deliver vast quantities of fine quality parts in a given time period. You also know that delays due to set-up difficulties and failure to hold expected tolerances can stand in the way of profits. Boyar-Schultz Screw Machine Tools are specially designed to help get full quality as well as full quantity production. Because our experts KNOW the operators' problems they are constantly working to develop tools that make the more difficult jobs, profitable operations. To get top quality, to hold down costs, it will pay you to use Boyar-Schultz Screw Machine Tools.

Boyar-Schultz corporation

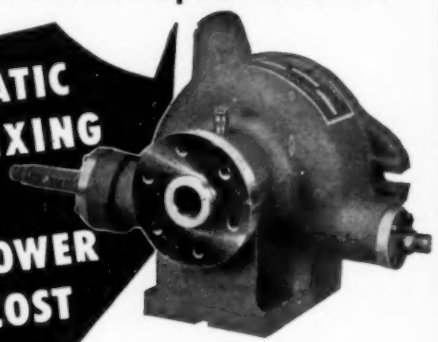
2105 Walnut St., Chicago 12, Ill.

401 Broadway, New York 13, N.Y.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-150-1

ONLY ERICKSON Speed Indexers give you

AUTOMATIC INDEXING at LOWER COST



Designed to Speed Up and simplify Positioning and Holding Operations.

CAN BE USED IN Horizontal or Vertical Positions

Indexer Prices Start at Only $275.00

Speed up those time consuming index jobs, bring productive costs down. Look at these exclusive Erickson Features:

1. Positive locking independent of air or hydraulics.
2. Longer Spindle Bearing for rigidity—accuracy.
3. Easy adaptability for automatic operation—micro switch can be used directly with plunger pin which engages index plate.
4. Adjustable to 4, 6, 8, 12, 24 positions.
5. 400 series adaptable up to 50 positions.
6. 600 series adaptable up to 100 positions.

NEW 3-POSITION INDEXER

Now, Operations requiring 3 divisions (120°) can be done faster, at lower cost, with easily adapted Erickson 3-Position Indexer!

WRITE TODAY FOR CATALOG F

ERICKSON TOOLS DIVISION

2316C Hamilton Ave. Cleveland 14, Ohio

USE READER SERVICE CARD; INDICATE A-10-150-2

XPEDITORS GUARANTEED TO SAVE YOU TIME

★ on clean up job
★ production
★ in semi-automatic machines

The XPEDITOR is the latest development in portable, high speed abrasive belt grinders. Instantly adjustable to any angle to give operators full view and control . . . swivels 360°. Equipped to do line contact, free belt and precision platen grinding and contour polishing. Speeds deburring and clean-up jobs; also used with jigs or fixtures or automatic feeding as a production unit . . . guaranteed to increase productivity. Write for bulletin #X-2

HESTON & ANDERSON KIRKWOOD STREET FAIRFIELD, IOWA

USE READER SERVICE CARD; INDICATE A-10-150-3

Yes, only GREENFIELD with its GEOMETRIC Division manufactures in its own plants, a complete line of Cutting Tools plus Gages! Yes, only GREENFIELD could duplicate the above tooling and top it off with all necessary Gages.

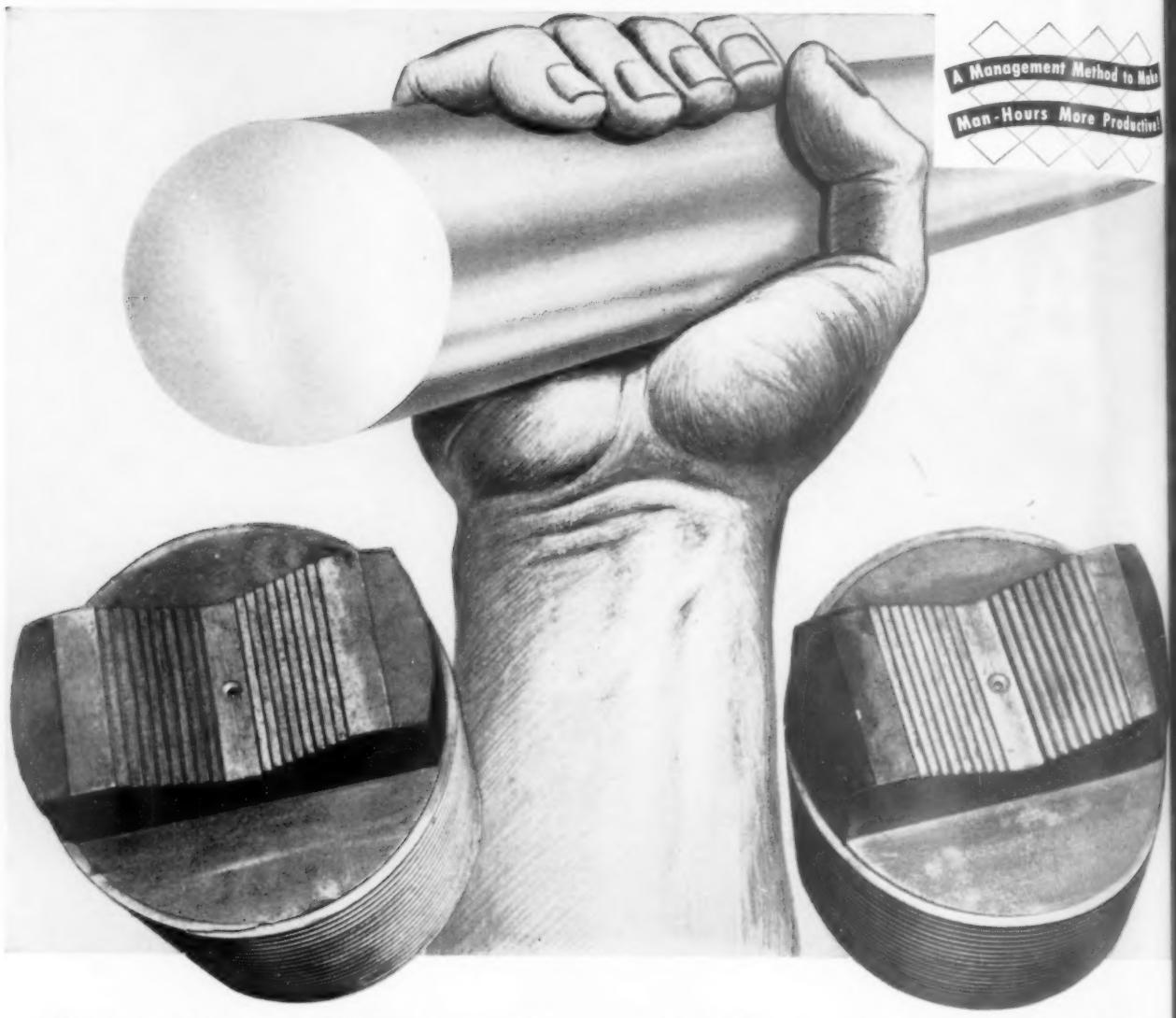
REGULAR STOCK ITEMS

	Capacity From	To		Capacity From	To
TAPS and COLLAPSING TAPS...	0–80	8½"–8	DRILLS.....	#80	3½"
DIES and DIE HEADS.....	0–80	6"–7	REAMERS.....	7/0	2½"
GAGES—THREAD.....	0–80	1½"–6	END MILLS.....	1/16"	2"
GAGES—PLAIN.....	.059"	4.510"			

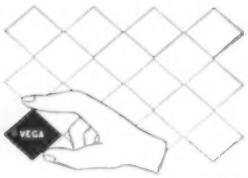
BUY TOOLS WITH *CONFIDENCE* BUY *GREENFIELD* TOOLS

GREENFIELD TAP AND DIE CORPORATION

GREENFIELD, MASSACHUSETTS



You Can Tighten Your Grip on Production with This Method



These giant jaws, made from Vega (Air-Tough) Tool Steel, grip 13½" round steel billets during rough turning in the largest machine of its type. Steady, uninterrupted production in the operation depended largely on quickly finding the right tool steel.

The company had been using an oil-hardening steel for jaws in normal-sized machines. But when the new giant came along it was a different story. Now a steel was needed that would harden uniformly, and *through very heavy sections*. By using the Carpenter Matched Set Method, the company was right the first time in selecting Vega . . . and saved costly experimenting with different tool steels. More important, production management was able to put the jaws in operation, knowing they could depend upon heavy production schedules being maintained.

This workable Method offers your plant more advantages than accurate, simplified tool steel selection. It can help you make machine operators more productive. It can do a lot to make heat treating a "routine", trouble-free procedure. It can hold your tool steel inventories to a minimum. Find out how, why and where it can work for you. Write for the new booklet "How to Get Better Tool and Die Performance". THE CARPENTER STEEL CO., 154 W. Bern St., Reading, Pa.

Export Department: The Carpenter Steel Co., Reading, Pa.—"CARSTEELCO"

Carpenter

MATCHED TOOL & DIE STEELS

More than top-grade steels . . . a Method to keep tooling and production on schedule!

For your convenience, Carpenter carries warehouse stocks in principal cities throughout the country

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-152

UNSURPASSED INSPECTION VERSATILITY

With Jones & Lamson Optical Comparators

PRODUCTION INSPECTION ON THE SPOT

TOOLROOM CHECKING OF EVERY KIND

LABORATORY GAGING WITH SPEED AND PRECISION

★ They meet the requirements of toolroom, laboratory and production inspection.

★ They precisely measure height, depth, lead or spacing, as well as angles to degrees and minutes.

★ They compare intricately contoured parts with a master outline – and measure the amount of error.

★ They are convenient to operate, easy to set up and read direct – without computation.

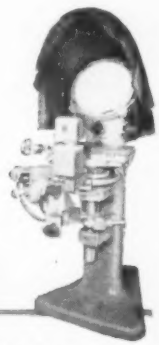
★ They will photograph the enlarged shadow and record its relationship to a master chart.

★ They will operate under normal lighting conditions. No dark room is needed.

★ Several persons may study the shadow at the same time.

★ They will inspect and measure surfaces, as well as profiles, of objects such as type faces, stamping dies, punches, worn tools, etc.

Jones & Lamson Optical Comparators are built in many models and sizes. We shall be glad to send catalog giving full details. Better yet, send us parts or prints with a description of your measuring and inspection problems – we shall be pleased to help.



Optical Comparator Division

JONES & LAMSON

MACHINE COMPANY
Springfield, Vermont, U.S.A.

Machine Tool Craftsmen Since 1835

Tool Engineers Handbook

A massive reference covering all mechanical processes employed in engineering raw materials into finished products

2150 pages . . . over 1500 illustrations . . . written by 144 authorities . . . brings together definitions, procedures, tables, charts, symbols, for which you might otherwise consult a number of scattered sources.

Over 24,000 men are now using the ASTE Handbook

ORDER YOURS NOW!

PRICE

Member $11.00
Non Member.....$15.00

Please send the "Tool Engineers' Handbook" to the address below:
Payment enclosed in the amount of $..... Orders shipped to Canada will enter the country duty and tax free. Remittance may be made in Canadian funds at the same prices. Shipments to other countries are subject to import regulations.

Name .....

Chapter (if member) .....

Business Title..... Firm Name.....

Street Address.....

City..... Zone.... State.....

Remittance payable to the Society must accompany order. Do not send currency. Mail this order coupon or a facsimile to: American Society of Tool Engineers, Dept. 3, 10700 Puritan Ave., Detroit 21, Mich.
IMPORTANT—In order to obtain the special, member price of $11, orders must be sent to the Society.

Talide

(TUNGSTEN CARBIDE)

MEETS EVERY REQUIREMENT

METAL CARBIDES CORPORATION

YOUNGSTOWN 7, OHIO

SINTERED CARBIDES—HOT PRESSED CARBIDES

USE READER SERVICE CARD; INDICATE A-10-155-1

CUT YOUR COSTS

WITH

RUTHMAN GUSHER

MACHINE TOOL COOLANT PUMPS

It is no wonder that machine tool builders everywhere say, "Gusher Coolant Pumps are a definite factor in cutting cost of machine operation."

Compare these outstanding characteristics built into every Gusher Pump, pre-lubricated heavy-duty ball bearings, totally inclosed drip-proof motor, lower power consumption when throttled, no priming, no packing. Your Gusher Pump will give you longer service with minimum maintenance cost.

"GUSHER," A Modern Pump for Modern Machine Tools

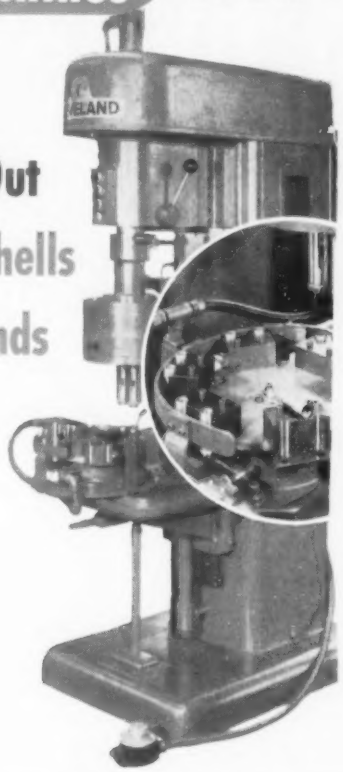
THE RUTHMAN MACHINERY CO.

1010 READING RD., CINCINNATI, OHIO

USE READER SERVICE CARD; INDICATE A-10-155-2

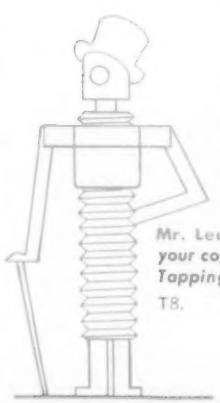
CLEVELAND tapping machines lead screw

CLEVELAND Tapper Turns Out Two 20 MM Shells Every 6.1 Seconds



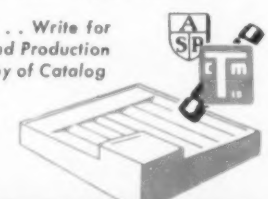
Operating at 100% efficiency, the CLEVELAND Tapper we designed for munition makers taps two 20 MM shells per machine stroke at the rate of 1180 pieces per hour. It uses a stroke of ½" cutting at a spindle speed of 420 RPM at 68 SFM with a tapping cycle of 36 turns or 5.1 seconds plus 1.0 second for the table index, making a total work cycle of 6.1 seconds for the two shells.

Other CLEVELAND models are producing such vital defense items as 3.5 rocket bodies . . . 90 MM shells. In many plants throughout this country and abroad CLEVELAND Tappers are reducing production costs and saving priceless man hours. A semi-skilled worker equipped with a CLEVELAND Tapper engineered to the job becomes a skilled operator



CHECK WITH CLEVELAND FIRST if you need to perform any of these operations: Tapping . . . Threading . . . Drilling . . . Spot-facing . . . Reaming . . .Chamfering. Cleveland engineers can help you with your problem, show you how to effect economies in these operations.

Mr. Lead Screw says . . . Write for your copy of the Cleveland Production Tapping Guide and a copy of Catalog T8.



THE CLEVELAND TAPPING MACHINE CO.

A Subsidiary of AUTOMATIC STEEL PRODUCTS, INC.

CANTON 6, OHIO

USE READER SERVICE CARD; INDICATE A-10-155-3

If you buy Cutting Tools

HERE'S HELP FOR YOU!

Are you responsible for purchase or specification of cutting tools—or wear and abrasion-resistant parts? You'll find the *Gorham* Tool Catalog a *helpful time saver!* 120 pages, packed with useful information, describe and illustrate the complete *Gorham* line—*PLUS* an informative section of Engineering Data. Request your free copy on company letterhead.

We also offer the service of *Gorham* field engineers, whose counsel in specification and design for special tooling problems is yours for the asking. Their recommendations are backed by *Gorham's* 25-year background in tool design, manufacture and heat treatment. Write for the name of your nearby *Gorham* representative.

Gorham TOOL COMPANY

14407 WOODROW WILSON DETROIT 3, MICHIGAN

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-156-1

TO OBTAIN FURTHER INFORMATION ABOUT ADVERTISERS, TRADE LITERATURE OR TOOLS OF TODAY APPEARING IN THIS ISSUE OF THE TOOL ENGINEER, USE THE HANDY READERS SERVICE CARD ON PAGE 115.

No Postage Needed

WHO WHAT WHEN WHERE

The old reliable . . .
Wm. H. Ottemiller Co., of course.

Precision, milled-from-the-bar Cap Screws, Set Screws, Milled Studs and Coupling Bolts.

Some numbers we can ship immediately—others—well, you know how it is—they'll take a little time.

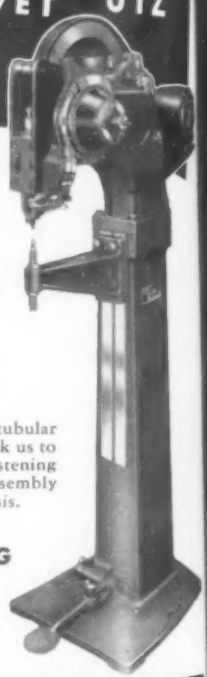
For special jobs contact us, for catalog items see your local Industrial Distributor.

Wm. H. Ottemiller Co., YORK, PA.

USE READER SERVICE CARD; INDICATE A-10-156-2

Chicago RIVET "912"

AUTOMATIC RIVET SETTER CUTS COSTS 3 WAYS



1 FASTENS FASTER . . .
Only the speed of the operator limits the 912's riveting speed. Completely automatic. A push on the foot pedal automatically feeds, inserts and clinches the rivet.

2 DOES WORK OF SEVERAL MACHINES
Quick change rotary hopper and raceway makes the 912 adjustable in 5 to 10 minutes to set different size rivets. Adjustable anvil height and 12-inch throat provide further versatility.

3 SAVES ON MAINTENANCE . . .
The 912 is massively built to stand the shocks of constant use and is designed for quick, easy servicing and parts replacement.

If your assembly calls for 3/16" steel tubular rivets or smaller, of ¾" lengths or less, ask us to show you how the 912 can cut your fastening costs. Send a sample of your problem assembly (or blueprint) for a free fastening analysis.

FREE CATALOG
contains valuable engineering information and rivet specifications plus illustrated descriptions of 26 Chicago Automatic Rivet Setters.

Chicago Rivet & MACHINE CO.

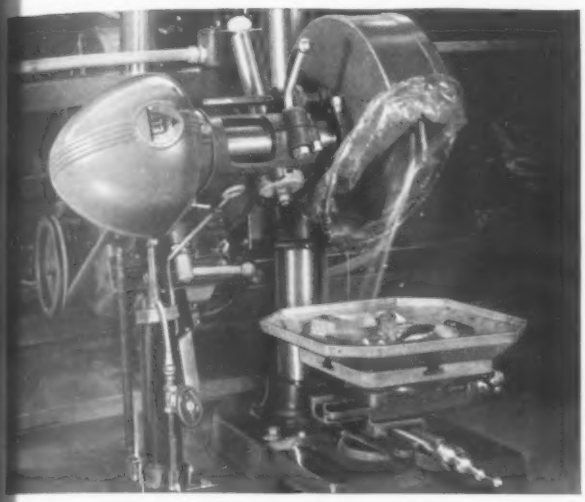
9619 West Jackson Boulevard, Bellwood (Chicago Suburb) Illinois

Branch Factory: Tyrone, Pa.

USE READER SERVICE CARD; INDICATE A-10-156-3

Quartz....Formica....Copper Tubing?

INGENIOUS Delta SET-UPS CUT THEM ALL



Cutting Quartz

National Scientific Products Co., Chicago, built a special mounting for Delta 14-inch drill presses, and fitted them with abrasive wheels, to cut wafer-thin quartz crystals for communication instruments. Side-mounted, pivoted drill press heads are actuated by a hydraulic-cylinder power feed. Curtain prevents lubricant splashing.

Cutting Copper Tubing

LeRoi Co., Milwaukee, fitted an adjustable reel to a Delta cut-off machine to cut copper tubing to length. Reel cuts handling time and labor costs, and permits under-bench storage of a variety of sizes.

Faced with problems of machining out-of-the ordinary materials, many shop superintendents and tool engineers have found the solution by adapting low-cost, high-precision Delta wood and metal working machines. Here are typical examples:

Cutting Formica

Boothcraft, Inc., Jamestown, N. Y., cuts Formica for restaurant counter and table tops on Delta Unisaws. Boothcraft also uses Delta disc sanders for finishing the edges of sheets of Formica, which has a hardness approaching steel.

There's a Delta Power Tool for Your Job-

WOOD OR METAL WORKING

53 MACHINES — 246 MODELS — MORE THAN 1300 ACCESSORIES

For Delta dealers, see your Classified Phone Directory under "Tools"

DELTA MILWAUKEE

DELTA POWER TOOL DIVISION

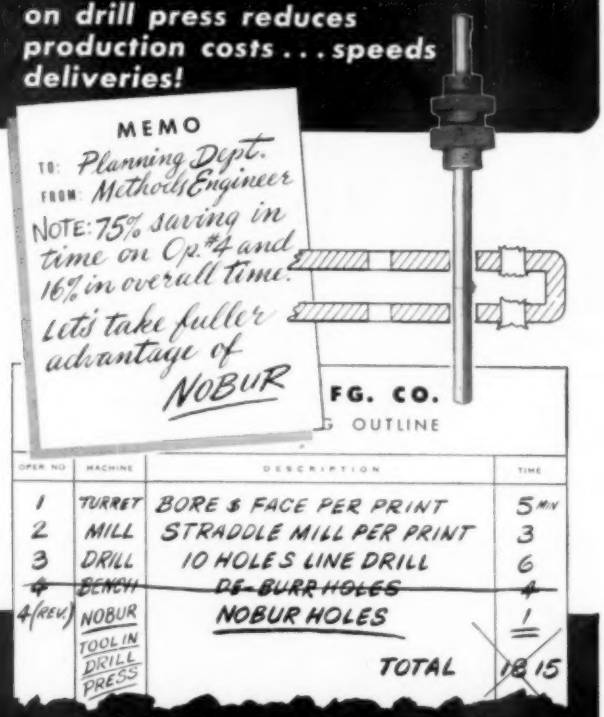
Rockwell

MANUFACTURING COMPANY

6111 E. VIENNA AVENUE • MILWAUKEE 1, WISCONSIN

Deburring with NOBUR tool

on drill press reduces production costs . . . speeds deliveries!


MEMO
TO: Planning Dept.
FROM: Methods Engineer
NOTE: 75% saving in time on Op. #4 and 16% in overall time.
Let's take fuller advantage of NOBUR
FG. CO.
OUTLINE
OPER NO | MACHINE | DESCRIPTION | TIME
1 | TURRET | BORE & FACE PER PRINT | 5 MIN
2 | MILL | STRADDLE MILL PER PRINT | 3
3 | DRILL | 10 HOLES LINE DRILL | 6
4 | BENCH | DE-BURR HOLES | 4
4(REV) | NOBUR TOOL IN DRILL PRESS | NOBUR HOLES | 1
TOTAL | 18 15

For further information, write or wire today

NOBUR MANUFACTURING COMPANY

717 NORTH VICTORY BLVD. • BURBANK, CALIFORNIA

USE READER SERVICE CARD; INDICATE A-10-158-1

HAVE YOU HEARD ABOUT THIS NEW METAL CLEANER?
IT CAN SAVE MONEY FOR YOU
New metal cleaner removes oil and rust in one operation

Oakite Compound No. 33 removes oil *at the same time* that it removes rust. And *at the same time*, it prepares metal for painting.

It's a great soak cleaner for steel, cast iron and aluminum; and great for hand-swabbing on metal surfaces too large to be soaked in tanks. *It frequently eliminates pickling operations on moderately rusty steel.*

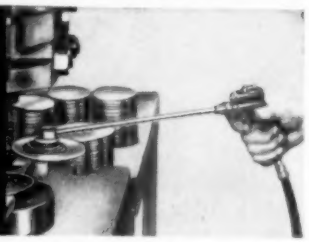
FREE For a copy of Folder F7993 *"New metal cleaner removes oil and rust in one operation"*, write to Oakite Products, Inc., 58 Thames St., New York 6, N. Y.

Technical Service Representatives in Principal Cities of U. S. & Canada

OAKITE SPECIALIZED INDUSTRIAL CLEANING MATERIALS • METHODS • SERVICE

USE READER SERVICE CARD; INDICATE A-10-158-3

FINGERS must be saved- KEEP THEM OUT OF PRESSES with LITTELL Pres-Vac Safety



30 Pres-Vacs cost less than the average cost of only one press accident.

Operated by Compressed Air

SAFETY FEEDERS

- Blanks are fed from a distance of 14 inches
- Eliminates need of putting fingers under press ram

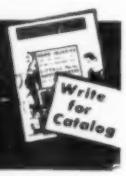
BOOST PRODUCTION 20% TO 100%
— Reported by users

ELIMINATE DIE BREAKAGE
— Assures Feeding Blanks One at a Time

CUT INSURANCE COSTS
— Fewer Accidents Mean Lower Premiums.

Littell Pres-Vac Safety Feeders are made in Single and Multiple types in a variety of cup sizes and styles.

F. J. Littell MACHINE CO.
AIR DIVISION
4199 RAVENSWOOD AVE., CHICAGO 13, ILL.
— District Offices: Detroit and Cleveland —



USE READER SERVICE CARD; INDICATE A-10-158-2

THE BEST FEATURES OF STEEL & CARBIDE ...TO SAVE MONEY ON PRODUCTION DRILLING

*PATENTED

Made to A.S.A. Standards; look into this "better" bushing, and cash in on the savings; write for catalog No. 13.

MEYCO

Carbide Inserted Bushings live longer, cost less in the long run.

Here is a bushing that combines the best features of steel and carbide: the protection of steel and the long life of carbide. First cost: slightly higher than ordinary steel bushings; their life: many, many times as great. In addition to such obvious savings, MEYCO bushings increase the life of drills and reamers, produce accurate work for a longer period of time, save on machine-down time and on non-productive man-hours.

PUMP MAKER SAYS: "We have a jig setup where four holes are held to a limit of plus or minus .0005" on the spacing. After completing 150,000 parts, MEYCO bushings show no sign of wear."

W. F. MEYERS CO., INC., BEDFORD, INDIANA

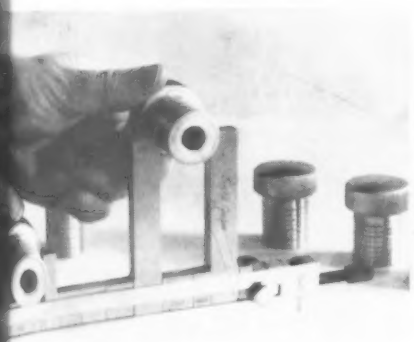
USE READER SERVICE CARD; INDICATE A-10-158-4

his DoALL Gage Equipment

makes

120,000 SNAP GAGES

accurate in millionths



at about 1/4 cent each!

A SET of 83 DoALL Gage Blocks plus the Gage Holders and Caliper Jaws illustrated gives you thousands of go and no-go snap and internal gages for a fraction of a penny each—in a jiffy. You get millionth accuracy and dimensional stability that you can depend upon.

DoALL Gage Blocks are no luxury. They are reliable, economical working tools every plant should have—dependable insurance against rejects. Ask to have a DEMONSTRATION in your plant. Call your local DoALL Sales-Service Store or write:

THE DoALL COMPANY, 254 N. Laurel Ave., Des Plaines, Ill.

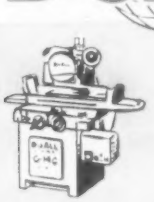
MODERN MEASUREMENT CONTROL

Send for this new 20 page Bulletin describing DoALL Gage Blocks and Accessories. Ask about DoALL Calibration Service for your present gage blocks!

INDUSTRY'S NEW TOOLS

DoALL

27 SALES-SERVICE STORES



Machine Tools . . . Gaging Equipment . . . Tool Steel . . . Band Tools . . . Metal Working Supplies

You Cannot Buy GOOD Power Tools For Less!

BOICE CRANE cost only slightly more than less accurate, limited capacity, homecraft type.

Here It Is! Positively the World's Lowest Priced COMBINATION CONTOUR SAW AND BAND FILER

There's Nothing Like It. No Shop Can Afford To Be Without It!

Produces maintenance parts, short run production parts, metal templates, special wrenches, wrench templates, cams, spiral parts, irregular shaped stacked parts, and stamping, forming and trimming dies in minutes instead of the hours required by old methods involving milling, shaping and hand filing. Does precision filing, file broaching and flash removal in 1/9 the time required by hand and ¼ the time required by reciprocating filing machine. 8 speeds, 92 to 4100 blade f.p.m. for accurate inside, outside and contour sawing of all industrial materials.

14" HIGH SPEED BAND SAW

Operates at 4100 blade f.p.m. Saws 2 to 4 times faster. Single and 8-speed back-geared models for smoother, more accurate cutting of practically any material. Clears 8⅝" under the guide.

Strong, one-piece welded steel frame. Wheels and blade, except at cutting point, entirely enclosed. Blade guides adjust by a single control, and with full safety, even when machine is running.

15" DRILL PRESSES WITH ⅝" DRILLING CAPACITY

50% thicker, more rigid column. Guaranteed closer tolerances where they count. 20% larger quill, 2-1/16" dia. Up to 50% more bearing against side thrust on quill when deep hole drilling and routing. Rugged steel (not die cast) 6-tooth splined drive sleeve. Far more sensitive, powerful feed. 50 high and slow speed bench and floor models. 1-2-3-4 spindles. Also complete line of popular price ½" capacity, 5-speed Drill Presses.

SPINDLE SANDER-GRINDER

Sands wood and does internal and external grinding of plastics, aluminum, masonite, brass, bronze, zinc and other metals up to six inches thick, straight and contours to as sharp a radius as ½". Ideal for patterns, templates, production. Table tilts 45° two ways, by sensitive worm and rack; accurate, quick-reading scale for beveling, drafting patterns and core-box work. Handles 1", 1½", 2" and 3" abrasive sleeves. Oscillates 83 strokes per minute at 2,500 r.p.m., to produce perfectly smooth, scoreless work.

24" x 5" HEAVY DUTY JIG SAW

Cuts plumb when sawing curves. Cuts up to 5" thick. Handles blades 5" to 9" long. 50% longer blade stroke cuts faster. Accurate, clean contour and straight cutting, inserted blade work, die filing, saber sawing and sanding. Blades turn 90 degrees for ripping long stock. Correct tensioning of tiny fret blades up to heavy-duty blades for metal. Table tilts two ways to 45°.

— Prompt Delivery Through Industrial Supply Distributors —

BOICE-CRANE COMPANY

934 Central Avenue **Toledo 6, Ohio**

Please send ( ) Boice-Crane Drill Press Catalog; ( ) Boice-Crane Band Filer Brochure; ( ) Boice-Crane Band Saw Brochure ( ) Spindle Sander Brochure ( ) Jig Saw Brochure.

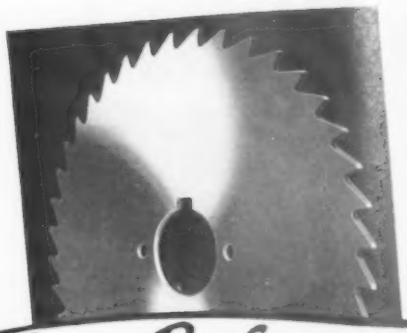
NAME .....

FIRM .....

STREET .....

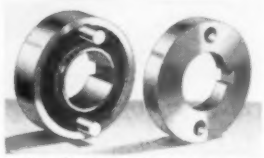
CITY & STATE .....

USE READER SERVICE CARD; INDICATE A-10-160-1



For ACCURATE *Performance and* HIGH *Production...*

USE MOTCH & MERRYWEATHER *Master-Cut* SLITTING and SLOTTING SAWS



Less breakage with Dual-Drive!

Better, but no higher priced—M. & M. Master-Cut slitting saws. Strong tooth form. Ample side clearance and flat hub avoid binding. Firm clamping, accurate cutting. Exclusive Dual Drive or conventional key drive.

See your local dealer for quick service.

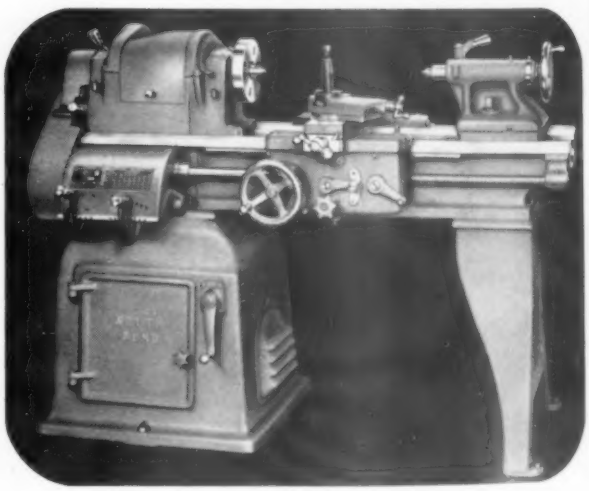
THE MOTCH & MERRYWEATHER MACHINERY CO.
PENTON BUILDING • CLEVELAND 13, OHIO

COMMAND OUR UNPARALLELED EXPERIENCE IN CIRCULAR SAWING

USE READER SERVICE CARD; INDICATE A-10-160-2

SOUTH BEND

14½" LATHES FOR FAST PRECISION MACHINING



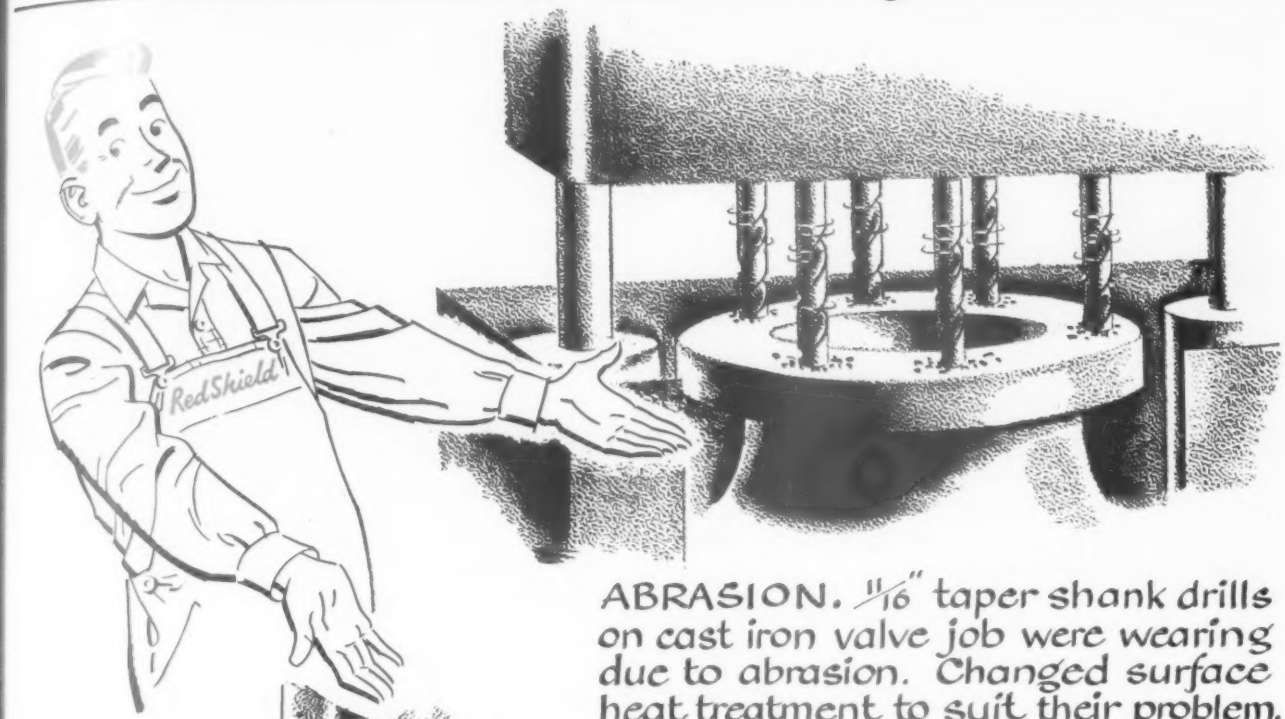
South Bend 14-1/2" Lathes hold down machining costs on work that requires extreme accuracy. They are fast and easy to operate... and readily adaptable to a wide variety of jobs. *Write for Catalog.*

SOUTH BEND LATHE

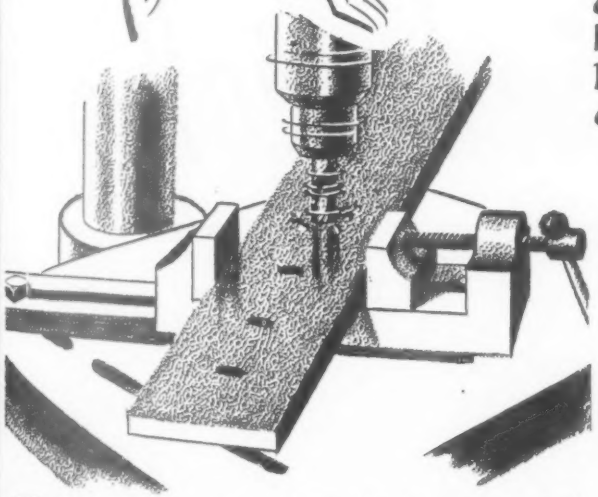
Building Better Tools Since 1906 • South Bend 22, Indiana

USE READER SERVICE CARD; INDICATE A-10-160-3

DRILLING POINTERS..... by Red Shield



ABRASION. 11/16" taper shank drills on cast iron valve job were wearing due to abrasion. Changed surface heat treatment to suit their problem. Drill life increased beyond all expectations.



STAINLESS. Regular drills averaged 3 holes per grind in tough work-hardening stainless steel. We suggested No. 506 F Fast Spiral Drill with special heat treatment and point. ...Now get more than 90 holes per grind.

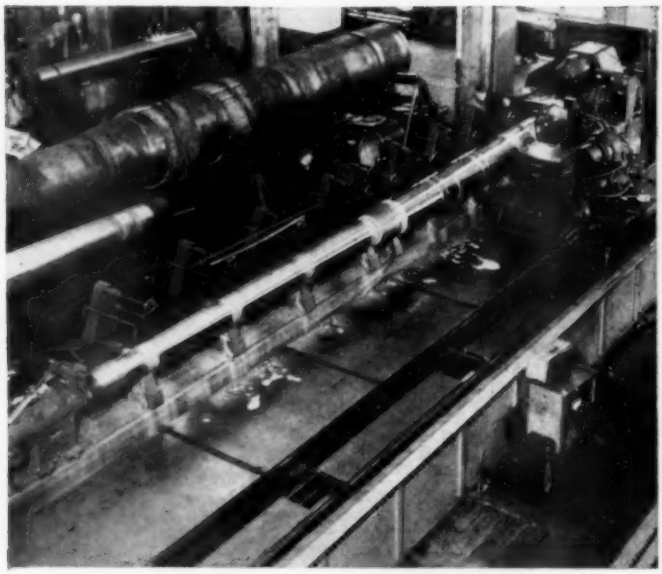
SERVICE. 70 years' experience behind our Red Shield Service Staff...to help solve your metal cutting problems. Get in touch with your local Standard Tool Co. distributor.

STANDARD TOOL CO.

DEPT. 1-F, 3950 CHESTER AVENUE
CLEVELAND 14, OHIO

New York • Detroit • Chicago • San Francisco

THE STANDARD LINE: ***Drills • Reamers • Taps • Dies • Milling Cutters • End Mills • Nobs • Counterbores • Special Tools***



Grinding an ordnance part on the world's longest cylindrical grinder. On big jobs like this, where spoilage is so costly, the correct Norton wheels assure you the most consistently accurate results.

A plunge-cut grinding job on a centerless grinder, showing use of a hand-operated sliding work rest. Units being ground are high speed steel drills, for which wheels of Norton ALUNDUM* (fused alumina), in the correct grain size and grade, give best results.

In Your *Cylindrical* or

It's easier to

GET MORE UNITS { *per dressing* / *per hour* / *per wheel*

WITH NORTON O. D. GRINDING WHEELS

You want your cylindrical or centerless grinding wheels to produce exactly the required tolerances and finish . . . in piece after piece . . . hour after hour . . . with a minimum of dressing or replacement.

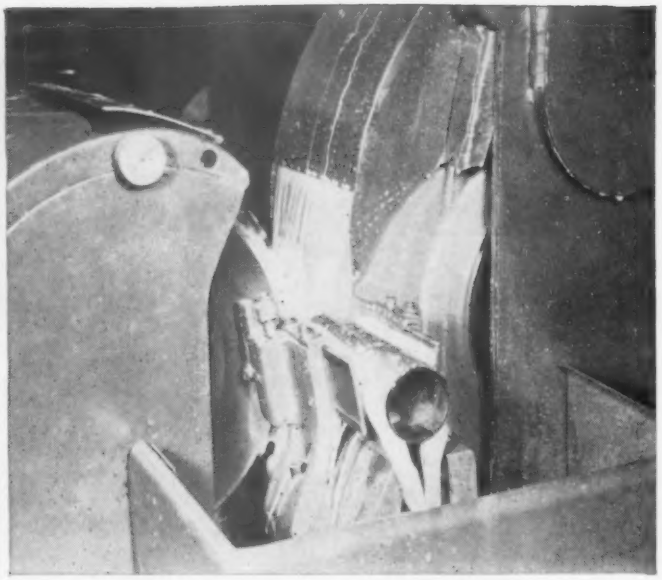
With Norton wheels it's *easier* to get these results. Here are the reasons:

1. Norton Range of Specifications Covers All Your O. D. Jobs. Whatever your material or job specifications — in the *complete* line of Norton wheels for O.D. grinding you're sure to find the *one* wheel with the *right* combination of abrasive grain type and bond for top cutting performance and extra long wheel life — and Norton uniformity assures this top performance in *every* wheel.

2. Norton Applicational Aid Covers Your Grinding Problems. In practically every case your Norton Distributor can quickly tell you which types of wheels you need. Backing him is the Norton Abrasive Engineer in your area. And behind both is the Norton technical staff, representing the resources and know-how of the world's largest manufacturer of abrasives.

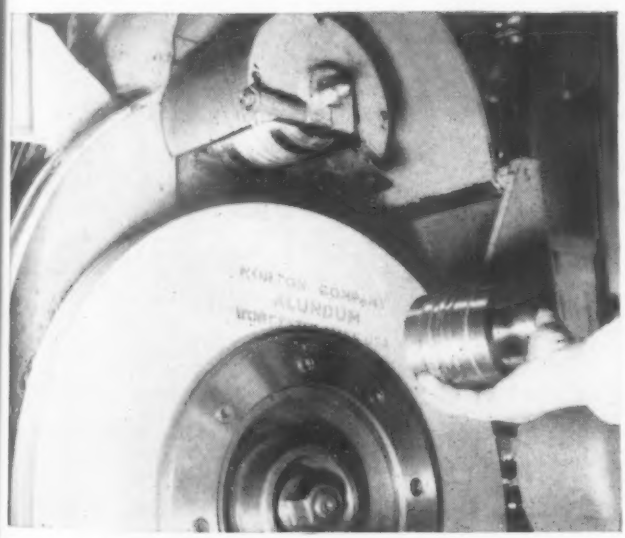
3. Norton Stocks Cover Your Delivery Requirements. Your Norton Distributor keeps ample stocks of popular O.D. wheel types and sizes. Larger stocks are maintained in Norton warehouses in key cities throughout the country, and you can always count on prompt shipments from Norton Company's complete stocks in Worcester.

Cylindrical grinding of four diameters at once. Here, close uniformity of wheels is vital — another good reason for choosing Norton grinding wheels with their proved ability to grind multiple diameters to exactly uniform size with a minimum of dressing.



Through-feed grinding of hollow tubing in a centerless machine. Norton wheels are your best bets for peak production and quality in O.D. grinding — on every type of material, from softest aluminum to hardest steel.

Centerless Grinding...



Shaping a wheel by crush truing, with hardened steel crusher roll shown in raised position. Both Norton ALUNDUM* and CRYSTOLON* wheels can be crush trued, to give excellent results in this rapidly growing method of grinding intricate O.D. contours.

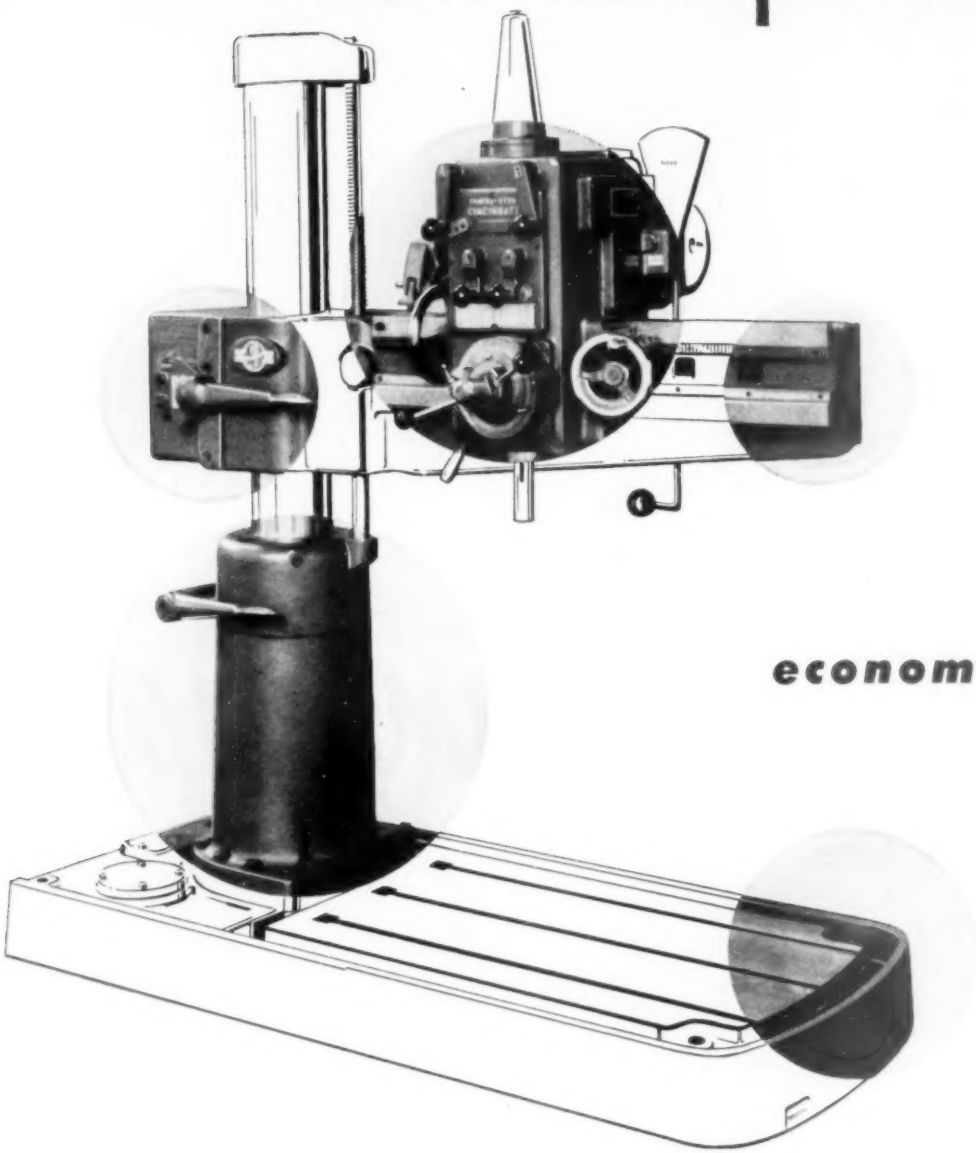
This handy, illustrated booklet gives you the essential facts of cylindrical and centerless grinding, answering many questions and providing convenient selection charts. Ask your Norton Distributor for *The A.B.C. of O.D. Grinding*, or write direct for Form 2006. NORTON COMPANY, Worcester 6, Mass. Distributors in all principal cities.

*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries

NORTON
ABRASIVES

Making better products to make other products better

feature-packed



economy priced

The new Canedy-Otto **CINCINNATI ROYAL RADIAL** (3-foot arm, 7-inch column) has the features you need to handle up to 90% of your drilling requirements. It combines low cost with such high-priced radial features as: all-geared head, automatically pressure lubricated, 9 spindle speeds (30 to 1 overall ratio), 6 power feeds, flame hardened transmission gears . . . all shafts mounted on anti-friction bearings . . . ground tubular steel column mounted on two Timken tapered bearings . . . simple, trouble-proof column and arm clamps . . . hardened and ground head rail on arm . . . extra heavy base. Catalog CO-15 on request.

CANEDY-OTTO DIVISION

CINCINNATI 9, OHIO, U.S.A. **cincinnati lathe & tool co.**

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-164

Why UNBRAKO® "STANDARDS"

"Standards" keep you in the BLACK

Standard design and purchase | Standard tools | Standard (fast) production with "standards" from stock | Standard (or higher) profits

"Specials" put you in the RED

Special design | Special drawings | Special purchase | Special (delayed) delivery | Special stock

Special tools | Special production | Special bookkeeping | Special costs (higher) | Special profits (lower)

Knurled Socket Head Cap Screw | Flat Head Socket Cap Screw | Self-Locking Knurled Point Socket Set Screw | Knurled Socket Head Shoulder Screw | Fully-Formed Pressure Plug | Precision-Ground Dowel Pin

STANDARD recommends "Standards"

SPS STANDARD PRESSED STEEL CO.

JENKINTOWN 37, PENNSYLVANIA

SCHERR LIMITED BUDGET INSPECTION LABORATORY

is a **MUST** *for all* **PRECISION WORK**

A COMPREHENSIVE SET OF MEASURING TOOLS AND INSTRUMENTS providing means for indisputable control of all precision work.

THICKNESS, DIAMETERS, LENGTHS, PROFILE, SHAPE AND FINISH — Simple in construction, reasonable in price, and fully reliable for unerring accuracy and wherever possible independent of the human element of "feel".

SAFEGUARD YOUR PRODUCTION

WRITE FOR DETAILS TO...

GEORGE SCHERR CO., Inc.

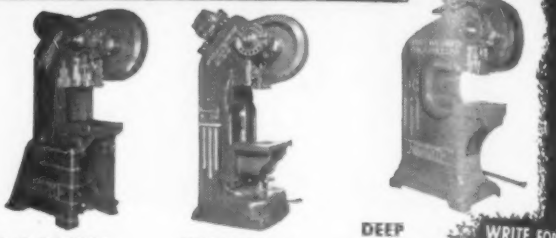
COMPLETE LINE OF PRECISION INSTRUMENTS

200 C LAFAYETTE ST. • NEW YORK 12, N.Y.

USE READER SERVICE CARD; INDICATE A-10-166-1

EFFICIENT—LOW COST PRODUCTION

MEANS **ROUSSELLE** PUNCH PRESSES



O. B. I. PRESS | HORN PRESS | DEEP THROAT | WRITE FOR DETAILS

SERVICE MACHINE COMPANY

7627 S. Ashland Ave. • Chicago 20

USE READER SERVICE CARD; INDICATE A-10-166-3

Empire **LIVE CENTERS**

• ACCURATE • VERSATILE • HEAVY DUTY

Manufactured in all tapers, 1 to 6 MT in stock. Special shanks and points made to order.

Ask your Supplier or Write for Literature.

ROYAL PRODUCTS

90 UNION ST. MINEOLA, N. Y.

Points illustrated are standard.

USE READER SERVICE CARD; INDICATE A-10-166-4

GET MORE PRODUCTION OUT OF YOUR PRESENT POWER PRESS EQUIPMENT

with the

V&O FEED-O-MATIC POWER PRESS FEEDER

Installed on Any Make Press for Secondary Die Operations

- Increases secondary die operation production up to 50% —— 100%, and higher, *with safety!*
- Makes operator's job easier . . . safer.
- Increases die life.
- Requires no special dies.
- Can be set-up for new work in 1-hour, or less.

Write for Illustrated Booklet

THE V&O PRESS COMPANY

DIVISION OF EMHART MANUFACTURING COMPANY

Builders of Precision POWER PRESSES and FEEDS Since 1889 **HUDSON, N.Y.**

USE READER SERVICE CARD; INDICATE A-10-166-2

...nothing like it!

for precision grinding, turning and milling

CHAMPION

Precision Expanding Mandrel

Entirely new in principle, this positive drive, quick change work mandrel cuts handling time . . . guarantees concentricity . . . eliminates arbor pressing and collecting.

Lower cost production is assured with faster work, fewer rejects, less tool cost. Arbor is built for heavy loads. Sleeve closes at .003" under and opens to .007" over nominal size. Positive stop prevents overstrain. Holds tolerances of less than .0002" run out.

Standard sizes from 1/2" through 3" diameter, graduated by 1/16", fit your machine. Special sizes if required. More details on request.

Write Dept. TE

The WESTERN Tool & Mfg. Co., Springfield, Ohio

USE READER SERVICE CARD; INDICATE A-10-166-5

HERE IS A DoALL BAND MACHINE FOR EVERY PURPOSE AND EVERY POCKETBOOK

THE LOW COST "UTILITY" SERIES BAND SAWING AND BAND FILING MACHINES
THE GENERAL PURPOSE "ML" SERIES CONTOUR MACHINES
DoALL
THE HIGH SPEED "ZEPHYR" SERIES CONTOUR MACHINES

• Four models—16" throat. Variable dual speed range 50 to 350 F.P.M. and 360 to 5200 F.P.M. Also available fixed speed. For small shops and experimental or model work in large shops.

• Five models—precision machines for general purpose band machining. 50 to 1500 F.P.M. variable speed for conventional metal cutting. ½ to 2 H.P. Throat depths 16" to 60". These are multi-purpose machines—sawing, filing, polishing.

• High speed—500 to 15000 F.P.M., fixed or variable. 16" to 60" throats. 2 H.P. to 15 H.P. For high speed sawing of non-ferrous metals and non-metallics, friction cutting ferrous sheet, plate up to 1".

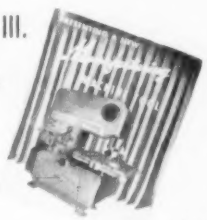
...e features and capabilities of all other ...s *plus* hydraulic controls, wider speed ...more power, greater tool variety, etc. ...ny material, any shape. Use as all-purpose ...gle purpose tool—works faster, better; ...osts, increases output per man.

EVERY SHOP can have the benefits of DoALL band machining, the fast, economical process that "slices" material apart instead of reducing it to pile of chips. There is a line of DoALL Band Machines and Band Tools for precision cutting every material, every conceivable shape—sawing, line grinding, polishing, honing, friction sawing, cutting. For production, for maintenance, for toolmaking—there is a DoALL machine to save manhours, material and money, to free other machines to work for which they are better suited. Find out what DoALL can do for you. Ask to have a DEMONSTRATION of a DoALL Band Machine right in your plant. Call your local DoALL Sales-Service Store or write:

THE DoALL COMPANY • 254 N. Laurel Ave., Des Plaines, Ill.

SEND FOR CATALOG ➧ ➧ ➧ ➧

Learn about the complete machining facilities offered by modern DoALL Band Machines.



INDUSTRY'S NEW TOOLS **DoALL** 27 SALES-SERVICE STORES

B-3

Machine Tools . . . Gaging Equipment . . . Tool Steel . . . Band Tools . . . Metal Working Supplies

"no more GAMBLING on tool steel selection"

[⅓ actual size; Selector is in 3 colors]

Since the first announcement, hundreds of tool steel users have received their CRUCIBLE TOOL STEEL SELECTORS. The comments received indicate that this handy method of *picking the right tool steel right from the start* is going over big.

"Handiest selector I've ever seen"

"No more gambling on tool steel selection"

"You're right, the application should dictate the choice of the tool steel" . . . and many, many more favorable comments.

You'll want your CRUCIBLE TOOL STEEL SELECTOR. It uses the only logical method of tool steel selection—begin with the application to pick the right steel! And the answer you get with one turn of the Selector dial will prove satisfactory in every case, for the CRUCIBLE TOOL STEEL SELECTOR covers 22 tool steels which fit 98% of all Tool Steel applications. ALL the tool steels on the Selector are in Warehouse Stock . . . that means when you get the answer, you can get the steel . . . fast!

Write for your Selector today! We want you to have it, because we know you've never seen anything that approaches your tool steel problems so simply and logically. Just fill out the coupon and mail. Act now! CRUCIBLE STEEL COMPANY OF AMERICA, Chrysler Building, New York 17, N. Y.

Here's how it works:

To use the Selector, all you need know is the characteristics that come with the job: type and condition of material to be worked, the number of pieces to be produced, the method of working, and the condition of the equipment to be used.

FOUR STEPS—and you've got the right answer!

1. Move arrow to major class covering application
2. Select sub-group which best fits application
3. Note major tool characteristics (under arrow) and other characteristics in cut-outs for each grade in sub-group
4. Select tool steel indicated

That's all there is to it!

Here's an example:

Application—Deep drawing die for steel

Major Class—Metal Forming—Cold

Sub-Group—Special Purpose

Tool Characteristics—Wear Resistance

Tool Steel—Airdi 150

One turn of the dial does it!

And you're sure you're right!!

Crucible Steel Company of America
Dept. T, Chrysler Building
New York 17, N. Y.

Gentlemen:

Sure! I want my CRUCIBLE TOOL STEEL SELECTOR!

Name_____ Title_____

Company_____

Street_____

City_____ State_____

CRUCIBLE

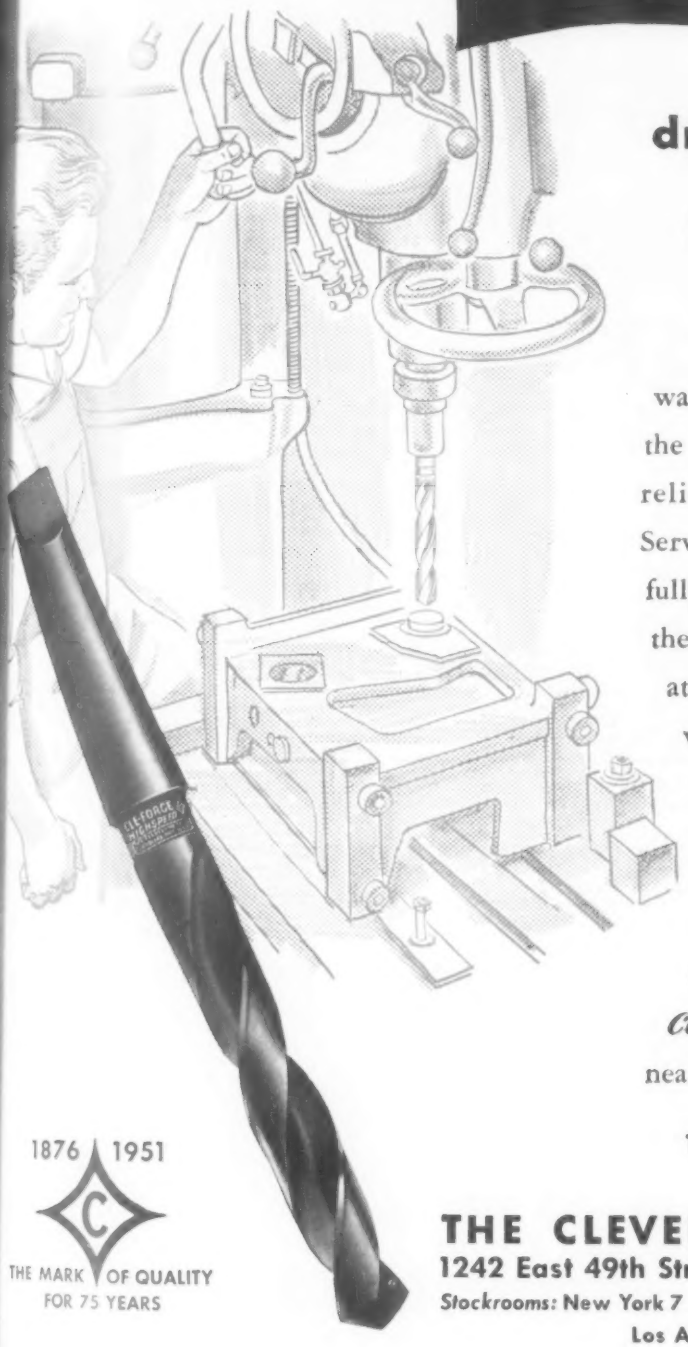
first name in special purpose steels

TOOL STEELS

fifty years of Fine *steelmaking*

Branch Offices and Warehouses: ATLANTA • BALTIMORE • BOSTON • BUFFALO • CHARLOTTE • CHICAGO • CINCINNATI • CLEVELAND • DENVER • DETROIT HOUSTON, TEXAS • INDIANAPOLIS • LOS ANGELES • MILWAUKEE • NEWARK • NEW HAVEN • NEW YORK • PHILADELPHIA • PITTSBURGH • PROVIDENCE ROCKFORD • SAN FRANCISCO • SEATTLE • SPRINGFIELD, MASS. • ST. LOUIS • SYRACUSE • TORONTO, ONT. • WASHINGTON, D. C.

NOW... ONE PASS



drills hole 3½ in. deep in 18-8 stainless steel

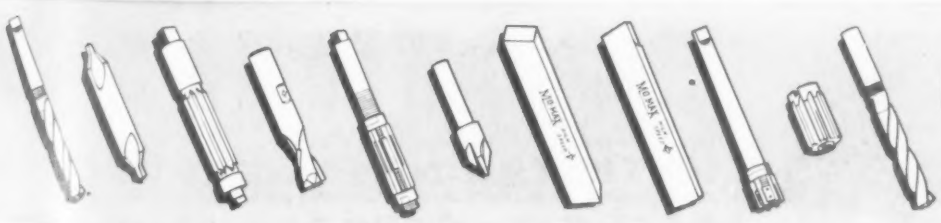
This was a slow and difficult job. There was considerable tool breakage, even though the operator made several pull-outs for chip relief on each hole. ◇ When a *Cleveland* Service Representative was called in, he carefully analyzed the set-up . . . and recommended the CLE-FORGE High Speed Drill illustrated at the left. This is a stock drill with a heavy web, and with flutes designed for easy chip removal. Now—because of the greater strength and rigidity of this drill—the deep holes are drilled in one pass. Breakage has been greatly reduced. ◇ Whenever *you* have a drilling problem, get the advice of a *Cleveland* Service Representative. Contact our nearest Stockroom, or . . .

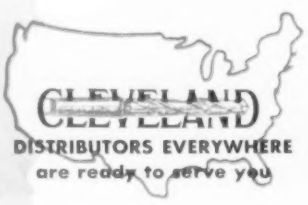
Telephone Your Industrial Supply Distributor

1876 | 1951

THE MARK OF QUALITY FOR 75 YEARS

THE CLEVELAND TWIST DRILL CO.
1242 East 49th Street **Cleveland 14, Ohio**
Stockrooms: **New York 7 • Detroit 2 • Chicago 6 • Dallas 2 • San Francisco 5**
Los Angeles 58 • London W. 3, England





ASK YOUR INDUSTRIAL SUPPLY DISTRIBUTOR FOR THESE AND OTHER *Cleveland* TOOLS

Get LONGER SERVICE FROM TAPS AND REAMERS!

Types to fit any machine used for tapping or reaming.

You may be discarding taps and reamers long before they are worn out if you are throwing them in the junk heap simply because they are not doing perfect work.

Before deciding that they are no longer usable, try them in a Ziegler Floating Tool Holder. In many cases you'll find that the trouble is due, not to the tool being faulty, but rather to a faulty setup. By using a tool holder which automatically compensates for spindle alignment inaccuracies of as much as 1/32" radius or 1/16" diameter, you can quickly tell where the blame should be placed.

You'll save money on tools if you check them with a Ziegler Holder before throwing them away.

W. M. ZIEGLER TOOL COMPANY

13574 Auburn — Detroit 23, Mich.

WRITE FOR CATALOG

Ziegler ROLLER DRIVE FLOATING HOLDER for Taps and Reamers...

USE READER SERVICE CARD; INDICATE A-10-170-1

Lang Tool and Die Manufacturing Company, Glendale, California, use Cerromatrix to anchor small punches in high-production lamination dies. They guarantee these dies for 2,000,000 blanks minimum.

Punches are held vertically by cap screws and mounted in Cerromatrix. Very small punches are held by circular washers outside and inside of punch, located in a 1/8" groove ground in the punch. All small punches are guided through a fixed stripper with Nitrided inserts.

At least 1/3 of the length of the punches is held in Cerromatrix. The photograph shows a die for rotor and stator blanks. It runs 135 strokes per minute. Eighty to eighty-five thousand blanks are obtained per sharpening of die. Send for literature.

CERRO de PASCO Corporation
(Formerly CERRO de PASCO Copper Corporation)
31 Pine St. — New York 5, N. Y.

USE READER SERVICE CARD; INDICATE A-10-170-2

BRING YOUR CARBIDE PROBLEMS TO

ADAMAS

Carbide Corporation

HARRISON, NEW JERSEY

at **BOOTH H-218**

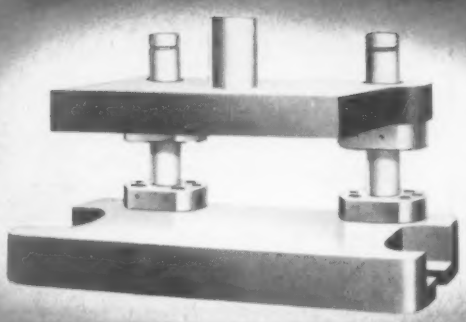
NATIONAL METAL EXPOSITION

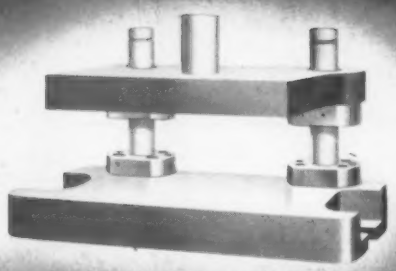
DETROIT • OCTOBER 15-19, 1951

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-170-3

BAUMBACH DIE SETS...

A reliable service for the Stamping Industry





BALTIMORE, MD.
Carey Machinery & Supply Co.
3501 Brehms Lane, P.O. Box 206
Telephone Broadway 1600

CLEVELAND, OHIO
Cutting Tools, Inc.
16809 Euclid Avenue
Telephone Ivanhoe 1-3737

DALLAS, TEXAS
Bill Lindsley Machinery Co.
3001 Elm Street
Telephone PRospect 1521

DAYTON, OHIO
E. C. Hawk Company
600 Wayne Avenue
Telephone Fulton 8155

DENVER, COL.
Technical Service Co.
408 Colorado Building
Telephone KEystone 6618

DES MOINES, IOWA
Iowa Machinery & Supply Co.
313-317 Court Avenue
Telephone 8-0123

EAST ST. LOUIS, ILL.
Nu-Way Machine & Die Works
1231-35 Piggott Avenue
Telephone Bridge 8378

ELKHART, IND.
Ernest, Holdeman & Collet, Inc.
820 N. Ward Street, P.O. Box 12
Telephone 3-2208 - 3-6164

GRAND RAPIDS, MICH.
Manufacturers Supply Co.
38 Commerce Ave., S. W.
Telephone 9-8336

INDIANAPOLIS, IND.
Indiana Mfrs. Supply Co.
937-945 Fort Wayne Avenue
Telephone Riley 2451

KANSAS CITY, MO.
Ernst Machinery Co.
5531½ Troost Avenue
Telephone DElmar 9600

LA CROSSE, WIS.
F. W. Burns Machinery Co.
332 Copeland Avenue

LOS ANGELES, CALIF.
Peck Steel & Die Supply
4436 Long Beach Avenue
Telephone Century 2-9291

MILWAUKEE, WIS.
F. W. Burns Machinery Co.
1730 W. North Avenue
Telephone FRanklin 4-1540

MONTREAL, CANADA
C. H. Smith & Company
667 St. James Street
Telephone University 4427

NEWARK, N. J.
Schultz & Anderson Co.
109 Edison Place
Telephone MArket 2-4318
Enterprise 6128

NEW BRITAIN, CONN.
Industrial Bench & Eq. Mfg. Co.
89 South Street
Telephone 3-0726

PORTLAND, ORE.
Machinery & Tool Supply Co.
15th and Yamhill
Telephone BEacon 6311 Ex. 226

ROCKFORD, ILL.
Rockford Industrial Steel Service
718 Market Street
Telephone 2-6658

ST. PAUL, MINN.
Sales Service Machine Tool Co.
2363 University Avenue
Telephone NEstor 8663

SEATTLE, WASH.
Machinery & Tool Supply Co.
1927 First Avenue, South
Telephone Main 6427

SPOKANE, WASH.
Machinery & Tool Supply Co.
421 W. 2nd Avenue
Telephone Main 2191

SYRACUSE, N. Y.
Burns Piping Supply Inc.
415-417 S. Clinton St.
Telephone 3-2131

TOLEDO, OHIO
Hage Industrial Corp.
4010 Lewis Ave.
Telephone Lawndale 1156

TORONTO, CANADA
Monarch Industries Ltd.
10 Sword Street
Telephone Randolph 7469

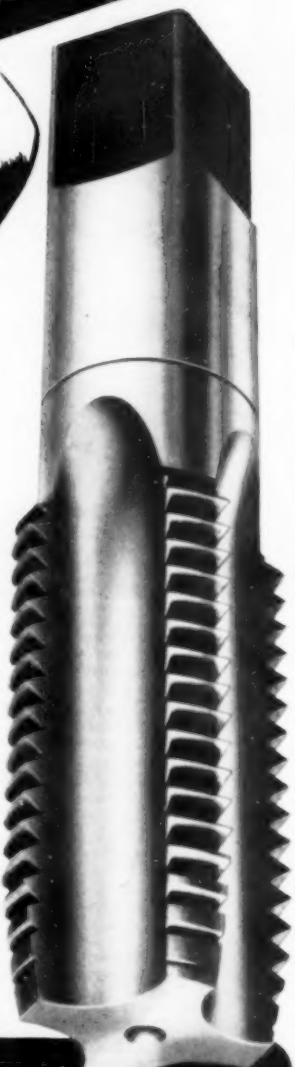
WASHINGTON, D. C.
Carey Machine & Supply Co.
2361 Sherman Ave. N.W.
Telephone Dupont 2204

E. A. BAUMBACH MFG. CO.

1810 S. KILBOURN AVENUE • CHICAGO 23, ILLINOIS

PRECISION

AND PERFORMANCE TOO



ON NEARBY SHELVES
OF INDUSTRIAL
SUPPLY DISTRIBUTORS

BAY STATE TAPS

BAY STATE TAP & DIE COMPANY
MANSFIELD, MASS.

USE READER SERVICE CARD; INDICATE A-10-172-1

GROBET CHATTERLESS COUNTERSINKS

They are terrifically popular with your trade because the six staggered cutting edges are scientifically designed to give a shearing cut and thus eliminate all chatter.
Made in 12 sizes in all degrees; also supplied as sets in strong Kit-cases.

Send for Catalog Sheet HC1

GROBET FILE CO. of AMERICA, INC.
421 CANAL STREET, NEW YORK 13, N. Y.
NEW YORK • CHICAGO • MONTREAL

USE READER SERVICE CARD; INDICATE A-10-172-2

A COMPLETE LINE OF BASIC
PRECISION INSPECTION EQUIPMENT

RAHN BLACK GRANITE

ACCURACY TO .00005"

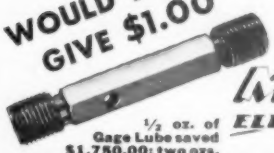
SURFACE PLATES — ANGLE PLATES — PARALLELS — STRAIGHT EDGES

Warp-free, Rust-free, Bump-free, Extra Hard, Super Smooth

FREE TRIAL! RAHN GRANITE SURFACE PLATE CO.
635 N. Western Dayton 7, Ohio

USE READER SERVICE CARD; INDICATE A-10-172-3

WOULD YOU GIVE $1.00 TO SAVE GAGES WORTH $1,000.00?



½ oz. of Gage Lube saved $1,750.00; two ozs. saved $1,000.00; a great motor firm saved 75% on gage costs! (Names on request.)

1. 2—10 times longer use.
2. No dimensional change.
3. Non-gumming; Non-loading.
4. Reduces scrapped parts.
5. Rust inhibiting.

MICRONOIL
ELECTRONIZED LUBRICANTS
GAGE LUBE

makes costly precision tools and gages wear longer! Yes, 300% to 800% longer!

Here's the deal

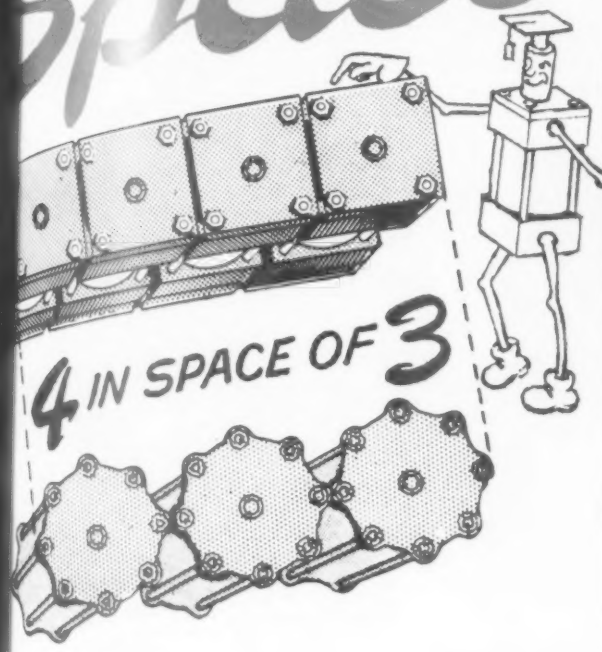
12 Two-oz. bottles.....$11.50
12 Four-oz. bottles..... 22.00
Pint bottles, each.... 7.00

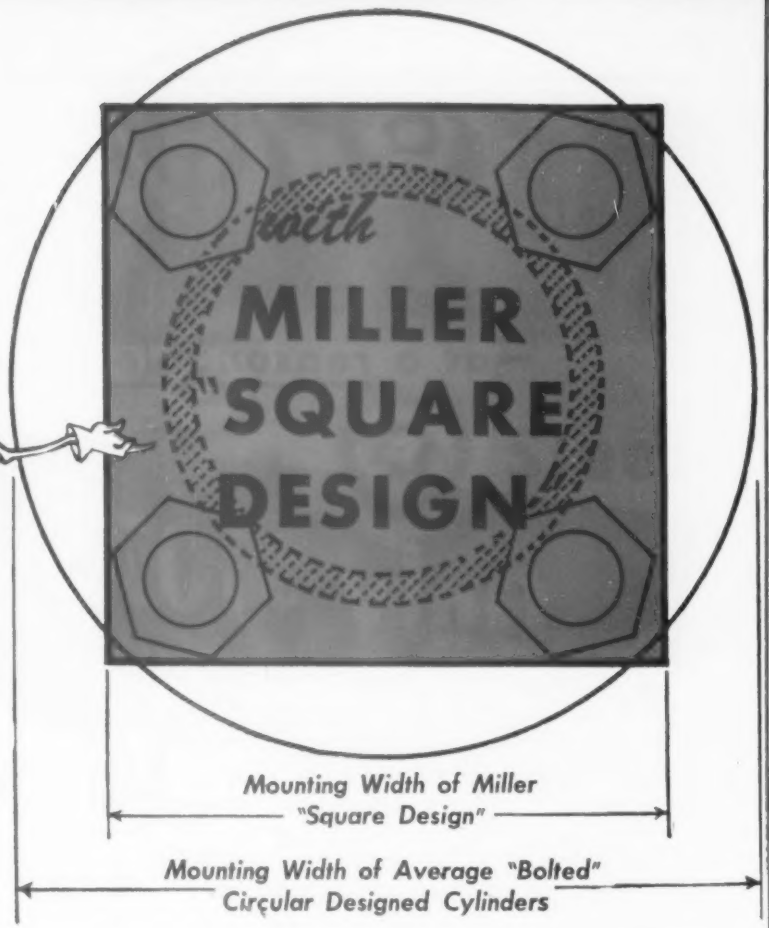
If you can't believe it, send $5.00 for 3 4-oz bottles on money-back guarantee.

PROTECTIVE COATINGS, INC. Detroit 27, Mich.

USE READER SERVICE CARD; INDICATE A-10-172-4

Save Space





Air *and* Hydraulic CYLINDERS...

The SQUARE DESIGN of Miller Cylinders saves up to 25% of mounting space, permitting more cylinder power in the same space and easier, more convenient installation in "tight spots." Thus, in many cases, machines and equipment can be designed more compact and less costly by using Miller Cylinders. Hours of drafting time can be saved — as only a few straight lines show any view on drawings.

The illustration at upper left shows graphically how *four* Miller Cylinders can be mounted, bore for bore, in the same space required for *three* average "bolted" circular designed cylinders. Some Miller bore sizes permit even greater space-savings.

Other important *standard* features of all Miller Cylinders include: solid steel heads, caps and mountings, hard chrome plated piston rods, dirt wiper seals, and other "quality" features as shown in illustrated bulletins sent FREE on request. Remember, too, that Miller Hydraulic Cylinders (2000-3000 psi) meet the J. I. C. Hydraulic Standards.

Write for illustrated cylinder bulletins A-105 and H-104

COMPLETE MILLER CYLINDER LINE INCLUDES: AIR CYLINDERS, 1½" to 20" BORES, 200 PSI OPERATION; LC PRESSURE HYDRAULIC CYLINDERS, 1½" TO 6" BORES FOR 500 PSI OPERATION, 8" TO 14" BORES F 250 PSI, HIGH PRESSURE HYDRAULIC CYLINDERS, 1½" TO 12" BORES 2000-3000 PSI OPERATION. MOUNTING STYLES AVAILABLE.

Miller

Benefits to You!

- More Cylinder Power in Same space
- Solve "Limited Space" Problems
- Simplify Designing and Installation
- Save hours of Drafting Time

MILLER MOTOR COMPANY

2010 N. HAWTHORNE • MELROSE PARK, ILL.

AIR AND HYDRAULIC CYLINDERS · ACCUMULATORS · COUNTERBALANCE CYLINDERS · BOOSTERS · AIR MO

CLEVELAND — PITTSBURGH — PHILADELPHIA — DETROIT — YOUNGSTOWN — BOSTON
HARTFORD — NEW YORK CITY — DAYTON — ST. PAUL — FORT WAYNE — INDIANAPOLIS
MILWAUKEE — NASHVILLE — SEATTLE — LOS ANGELES — SAN FRANCISCO — BALTIMORE
ST. LOUIS and OTHER AREAS

...les and Service from coast to coast

Now You Can Have All the Advantages of Machine Lapping
—*at a reasonable price*

Flat lapping a pump housing for an oil-tight seal.

Low in cost — economical to operate and maintain—this new lapping machine is ideal for high precision work both in the tool room and in small lot manufacturing departments. It is a high grade precision machine tool in every respect.

The lapping area is a full 24″ in diameter; plates are of close grained cast iron, heat treated and precision ground to ensure permanent flatness. The spindle is roller bearing mounted, and the base construction is of extreme rigidity.

The plates (grooved for flat work or plain for cylindrical pieces) are interchangeable in only a few minutes time. Plain plate standard; grooved plate $22.50 extra.

Mail this coupon today for a copy of the Taft-Peirce 24″ Rotary Lapping Machine bulletin with detailed information on machine and accessories.

Mail This Coupon Today!

THE TAFT-PEIRCE MANUFACTURING COMPANY
WOONSOCKET, RHODE ISLAND

Please send me a copy of your bulletin on the Taft-Peirce 24″ Rotary Lapping Machine.

Name_____

Company_____

Street_____

City_____ State_____

Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

esh-roasted Chisels lt Costly Breakage

oundry in the Middle West had long eeded on a rule-of-thumb heat-treater harden the large number of chisels they ed daily. One day he quit abruptly. No at concern was felt about his depar- e—until they began to break as many 00 chisels in one day.

A trouble-shooter, hurriedly sum- oned, soon traced the appalling break- e to the as-quenched brittleness of the sels. The departed heat-treater hadn't vealed how he relieved this condition. The trouble-shooter went on to explain at the chisels had to be tempered after rdening. But there was no suitable at-treating equipment in the foundry. obviously he hit on the answer. "Tell you hat—you can get one of those electric key roasters. They cost only about enty-five bucks and they'll give you a mpering range of about 250 to 500 F. st what you need."

The division foreman was dubious. ow could roasting the chisels do any ood? But he bought a roaster and put on the job. To his surprise it cured the reakage. In the first week they averaged ly one broken chisel a day. The roaster aid for itself in no time.

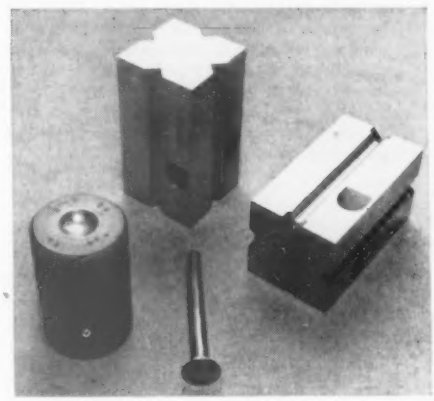
Many tools and dies fail because they aven't been tempered after hardening. ot holding tools at the tempering tem- erature long enough causes the same rt of trouble. Another important point: Always temper tools before they cool own to room temperature. Usually it's est not to let them cool below 150 F.

Cold-heading Die Steel Takes a Real Beating

Maybe you've seen a cold-heading machine in action, forging bolts, rivets, screws, and other products at high speed. The tools and dies which do the cutting, gripping, and heading have to be seen at work to be appreciated. Minute after minute, day after day, they withstand continuous terrific pounding.

Good cold-heading die steel—used for the solid, open, and header types of dies—must have a hard, long-wearing surface, reinforced by a tough core. The hard, wear-resisting case must be deep enough to prevent sinking or upsetting and tough enough to absorb heavy pounding without chipping or spalling.

Cold-heading die steel is one of our special-purpose tool steels. It took quite a few years to work out the right carbon content, depth of hardness, and grain size. For example, we've found that a shallow-hardening steel is best for header dies up to 2-in. diameter; for larger dies a deep-hardening steel gives longer service. Both are fine-grained tool steels, made ever so carefully to insure the ultimate in cleanliness and freedom from injurious defects.



These gripper and header dies of Bethlehem Cold-Heading Die Steel have the ideal combination of hard surface and tough core for cold-heading thousands of bolts each day.

We call it Bethlehem XX Cold-Heading Die Steel. It's really tops for this kind of punishing service. Like to know more about it? Address your request to our Publications Department, Bethlehem, Pa. Ask for Booklet 261.

Our Tool Steel Engineer Says:

A modified oil-quench gets rid of scale on air-hardening tool steels

Some toolmakers object to air-hardening steels because a thin, adherent scale may form during the air-quench. Avoiding this scale is really easy.

Quench the tool or die in oil until it just loses color . . . 900 to 1000 F . . . then cool it in air to about 150 F, followed by the usual tempering operation. The oil-quench will "throw" the scale. But the tool won't crack, because air-hardening steels do not begin to transform, or harden, until they reach 400 F or less.

However, air-hardening steels must *not* be quenched in oil long enough to cool them down below the temperature at which transformation takes place. If this precaution is ignored, cracking of the tool is likely to result.

Air-quenching, of course, results in the minimum amount of distortion.

Bethlehem ULTRASONIC TESTED **Tool Steel**

Assured Accuracy with

TUKON TESTER *for* **MICROHARDNESS TESTING**

Researchers and scientists accept TUKON's precision and repeated accuracy

● Where minute indentations and extreme accuracy are necessary, the TUKON Microhardness Tester meets the most exacting requirements. A sensitive mechanically or electrically controlled system, with microscopic viewer, is employed.

On hardened steel, length of indentation with 100 gram load is .0016", depth only .00005"; very small metallic crystal areas can be tested. TUKON models are available for testing delicate watch parts to properly prepared specimens of heavy machinery parts. TUKON is necessary in every metallurgical department.

Information on the correct TUKON Microhardness Tester for your work will be sent on request. Just give us details of the job.

ACCO

WILSON

MECHANICAL INSTRUMENT DIVISION
AMERICAN CHAIN & CABLE

230-1. Park Avenue, New York 17, N. Y.

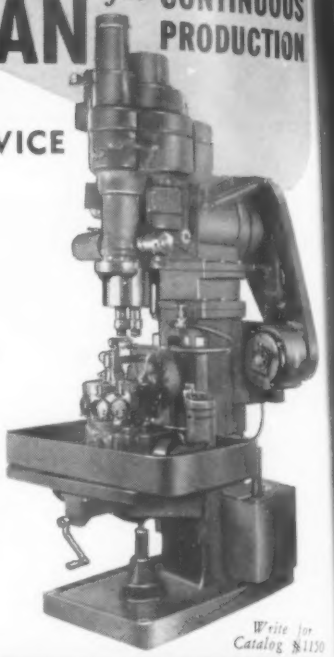
USE READER SERVICE CARD; INDICATE A-10-176-1

PRECISION BUILT

TAPPING MACHINES

KAUFMAN *for* CONTINUOUS PRODUCTION

HI-DUTY PRECISION SERVICE



- Fully automatic cycle.
- Lead Screw control with rapid traverse.
- Long wearing — instant reversing clutches.
- All internal moving parts run in oil bath.
- Speed changes by Selective Gearing.
- Quick changeover to handle various jobs.
- Can be used with single spindle or with multiple spindle heads.
- With or without automatic indexing fixture.

Write for Catalog S-1150

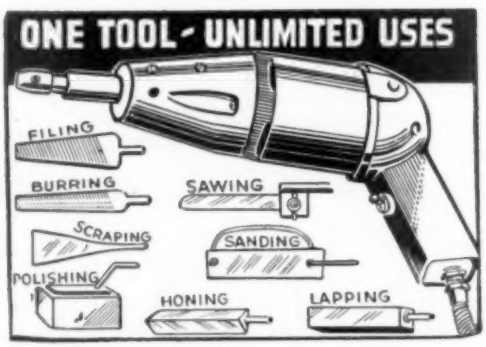
KAUFMAN MFG. CO.
MANITOWOC, WISCONSIN

USE READER SERVICE CARD; INDICATE A-10-176-2

B-R-E-A-K . . . .

Hand Finishing Bottlenecks

with PORTABLE - ELECTRIC RECIPROCATING TOOLS



These handy tools will cut out many tedious hand filing and finishing operations—Increase Production—Produce Uniform Work.

Light in weight—Delivers 1/8" or 3/8" fixed stroke at 1000 strokes per minute—operates on 110 volts AC or DC.

There's an ACME VISE FOR ANY JOB!

You have your choice of 11 Bench Vise sizes—from 2" to 6"—Light or Heavy Duty—Interchangeable Ground Jaws.

Combination Pipe and Bench Vises available with 3½", 4½" or 5" Jaws.

ACME TOOL CO.

75 W. BROADWAY NEW YORK 7, N. Y.

By installing Acme Bench Vises Now, you get longer vise life—greater holding power—outstanding performance under hard usage.

THESE ARE SOME OF THE THINGS A WELL-RUN EXPOSITION IN YOUR FIELD DOES FOR YOU:
Renews customer contact
Enables you to actually demonstrate your products
Brings your prospects to you
Introduces new products quickly
Produces inquiries and leads
Opens new markets for you
Establishes contact with people your salesmen can't reach
Builds sales organization confidence
Establishes your firm
Enables you to broaden your sales organization

Turning the tables on your customer

The 40-hour week is tough on your salesman. He can't reach all the people he should see. They haven't got the time to talk to him in THEIR place of business.

But there is one place where they do have time to talk to him—where they even ASK the salesman for a sales talk.

That time and place is at the particular Exposition which covers your own and your prospect's trade and industry.

Your prospects know that at these expositions they will find the latest and best products available in their and your field. They spend the time—plus millions of dollars—just to put themselves in a position where YOU can tell them about YOUR product.

Are you taking advantage of the opportunity?

ASTE INDUSTRIAL EXPOSITION

March 17-21, 1952 Chicago, Illinois

American Society of Tool Engineers

10700 Puritan Avenue Detroit 21, Michigan

Index of The Tool Engineer Advertisers

OCTOBER, 1951

The Index to Advertisers is published as a reader service. Although every precaution is taken to assure correct listing, no allowance will be made for error or omission.

A

Ace Drill Bushing Co. 136
Acme Industrial Co. 138
Acme Tool Co. 176
Adamas Carbide Corp. 170
Allegheny Ludlum Steel Corp. 140
American Broach & Machine Co.
Division of Sundstrand Machine Tool Co. 122
American Society of Tool Engineers 123-154-177
Ames, B. C., Co. 120
Ames Precision Machine Works 138
Anderson, F. E., Oil Co. 28
Armstrong-Blum Mfg. Co. 86
Automatic Steel Products, Inc.
The Cleveland Tapping Machine Co., Subsidiary 155

B

Baird Machine Co., The 135
Balas Collet Mfg. Co. 180
Bath, John Co., Inc. 129
Baumbach, E. A., Mfg. Co. 171
Bay State Tap & Die Corp. 172
Behr-Manning Corp. 127
Besly, Charles H., & Co. 143
Bethlehem Steel Co. 175
Boice-Crane Co. 160
Boyar-Schultz Corp. 150
Brown & Sharpe Mfg. Co. 26
Bullard Co., The 9
Butterfield Division-Union Twist Drill Co. 13

C

Card, S. W. Mfg. Co.,
Division of Union Twist Drill Co. 141
Carpenter Steel Co. 152
Cerro de Pasco Corp. 170
Champion Tool Co. 136
Chicago Rivet & Machine Co. 156
Chicago Wheel & Mfg. Co. 137
Cincinnati Lathe & Tool Co. 164
Cincinnati Shaper Co., The 8
Circular Tool Co., Inc. 87
Cleveland Tapping Machine Co., The
Automatic Steel Products, Inc., Subsidiary 155
Cleveland Twist Drill Co., The 169
Colonial Broach Co. 23
Columbia Tool Steel Co. 112
Conner Tool & Cutter Co. 114
Cosa Corp. 148
Cross Co., The 32
Crucible Steel Company of America 168

D

Danly Machine Specialties 22
Delta Power Tool Division-Rockwell Mfg. Co. 157
Detroit Die Set Corp. 103
Die Techniques Co. 110
DoAll Co., The 107-159-167
Dykem Co., The 136

E

Eastern Machine Screw Corp. 142
Eastman-Kodak Co., Industrial Optical Sales Division 113
Engis Equipment Co. 104
Ettco Tool Co. 95
Erickson Tools Division 150
Ex-Cell-O Corp. ..... Inside Back Cover

F

Federal Products Corp. 130
Fellows Gear Shaper Co. 104-111
Firth Sterling Steel & Carbide Corp. 125
Fuller Tool Co. 136

G

Glenzer, J. C., Co. 91
Golconda Corp. 166
Gorham Tool Co. 156
Greenfield Tap & Die Corp. 151
Greenlee Brothers & Co. 94
Grobet File Company of America 172

H

Hammond Machinery Builders, Inc. 97
Hanna Engineering Works 30
Hannifin Corp. 25
Hardinge Brothers, Inc. 3
Hartford Special Machinery Co., The 145
Heald Machine Co., The 24
Heston & Anderson 150

I

Illinois Tool Works 121

J

Jones & Lamson Machine Co. 153

K

Kaufman Mfg. Co. 176
Kelvin Engineering Co., Inc. 88
Kempsmith Machine Co. 111
Kennametal, Inc. 109

L

Landis Machine Co. 2
Lapointe Machine Tool Co. 16
Littell, F. J., Machine Co. 158
Lodding, Inc. 96

M

Makepeace, D. E., Co. 149
Mead Specialties Co. 85
Manhattan Rubber Division
Raybestos-Manhattan, Inc. 128
Meyers, W. F., Co. 138
Michigan Tool Co. 4
Miller Motor Co. 173
Milne, A. & Co. 99
Motch & Merryweather Machinery Co., The 160
Metal Carbides Corp. 155

N

National Broach & Machine Co. 19
National Twist Drill & Tool Co. 67
Nelco Tool Co., Inc. 98
Niagara Machine & Tool Works 20
Norbur Mfg. Co. 158
Norton Co., The 132-162-163

O

Oakite Products, Inc. 158
O'Neil-Irwin Mfg. Co. 84
Ortman-Miller Machine Co. 105
Ottemiller, W. H., Co. 156

P

Parker-Majestic Inc. 126
Pioneer Engineering & Mfg. Co. 109
Pioneer Pump & Mfg. Co. 109
Pope Machinery Corp. 139
Potter & Johnston Co.
Subsidiary of Pratt & Whitney Division
Niles-Bement-Pond Co. 119
Pratt & Whitney Division
Niles-Bement-Pond Co. ..... Inside Front Cover
Protective Coatings, Inc. 172

R

Rahn Granite Surface Plate Co. 172
Raybestos-Manhattan, Inc.
Manhattan-Rubber Division 128
Reed Rolled Thread Die Co. 89
Robertson Mfg. Co. 17
Royal Products, Inc. 166
Ruthman Machinery Co. 155

S

Scherr, George, Co., Inc. 166
Schrader's, A. Son 21
Scully-Jones & Co. 27
Seneca Falls Machine Co. 124
Service Machine Co. 166
Sheffield Corp. ..... Back Cover
Simonds Abrasive Co. 117
Simonds Saw & Steel Co. 14-15
South Bend Lathe Works 160
Standard Electrical Tool Co. 93
Standard Gage Co. 5
Standard Pressed Steel Corp. 165
Standard Tool Co. 161
Stuart, D. A., Oil Co., Ltd. 108
Sturtevant, P. A., Co. 134
Sundstrand Machine Tool Co.
American Broach & Machine Co., Division 138
Super Tool Co. 90
Swartz Tool Products, Inc. 179

T

Taft-Peirce Mfg. Co. 174

U

Union Twist Drill Co. 18
Universal Engineering Co. 133
U. S. Drill Head Co. 92

V

V & O Press Co. 166
Vanadium-Alloys Steel Co. 147
Van Keuren Co., The 134
Vascoloy-Ramet Corp. 105
Versa-Mil Co. 12

W

Wales-Strippit Corp. 144
Walker, O. S., Co., Inc. 136
Waukesha Tool Co. 134
Wendt-Sonis Co. 118
Wesson Co. 101
Western Tool & Mfg. Co. 166
Whistler, S. B. & Son, Inc. 102
Wiedemann Machine Co. 146
Wilson Mechanical Instrument Co. 176
Wilton Tool Co. 83
Winter Brothers Co.
Division of National Twist Drill & Tool Co. 6-7
Woodworth, N. A., Co. 130

Y

Yoder Co. 131

Z

Ziegler, W. M., Tool Co. 170

THE TOOL ENGINEER REGIONAL ADVERTISING OFFICES

EASTERN
Austin G. Cragg
400 Madison Ave.
Phone: Plaza 9-4018
New York 17, New York

OHIO
Richard E. Cleary
Commercial Bank Building
Phone: Berea 4-7719
Berea, Ohio

CENTRAL
Clarence T. Etter
10700 Puritan Avenue
Phone: University 4-7300
Detroit 21, Michigan

WESTERN
Stanley F. Girard
540 N. Michigan Ave.
Phone: Michigan 2-4465
Chicago 11, Illinois

PACIFIC COAST
W. R. McIntyre
423 First Trust Bldg.
Phone: Ryan 1-6981
Pasadena 1, California

SWARTZ TOOL PRODUCTS CO., INC.

13330 Foley Ave. Phone WE 3-1522 Detroit, Michigan

A two station index fixture to drill a circle of closely spaced holes in shaft flange. Lower adapter changed for various length parts. Top plate clamps part with standard lock.

DESIGNERS

BUILDERS

Specializing in all types of holding fixtures for machine shop production.

MANUFACTURERS OF STANDARD SWARTZ DRILL JIGS AND FIXTURE LOCKS

REPRESENTED BY:

SYRACUSE
Arthur Irvine

CLEVELAND
Production Tool Co.

MILWAUKEE
Geo. M. Wolff Co.

HOUSTON-DALLAS
Engineering Sales Co.

CHICAGO
Ernie Johnson

PITTSBURGH
Tool Engineer Products

PHILADELPHIA
Morgan Tool Equipment Co.

LOS ANGELES
Technical Broaching Co.

NEW ORLEANS
Engineering Sales Co.

CINCINNATI
R. W. Pratt

BOSTON
A. R. Shevlin & Co.

TOLEDO
Peerless Tool Service Co.

CANADA
Firth Brown Tools, Ltd.
Galt, Ont.

WRITE FOR CATALOG 941

proved on every machine

more production

lower costs

"CB" MASTER COLLET
U. S. PATENT NO. 2,228,337

Balas Master Collets for all multi-spindle automatics from 7/8" capacity and over.

BALAS COLLETS

Balas Master Collets reduce set-up time because they are front loading . . . the pads are easily changed without disturbing the setting of the collet. They run truer, grip tighter and work faster, increase your production and lower your costs regardless of the make of machine or type of material you use. In addition, Balas Master Collets handle stock to full capacity of the machine, thereby reducing collet inventory.

MODEL "A"
MASTER PUSHER

Balas Master Pushers for all sizes of automatics furnished with steel, cast-iron, bronze or hardened Meehanite pads depending on the requirements of the job.

BALAS PUSHERS

Balas Master Pushers eliminate lost production time by permitting rapid change-over from one stock size to another by merely changing pads. The unique design and construction of these pushers guarantee long trouble-free operation. Balas Master Pushers solve your difficult feeding jobs and speed up your production. They have proved to be outstanding "time-and-money-savers" on all types of machines in thousands of large and small plants throughout the nation.

Most standard sizes of Master Collets and Master Pushers are carried in stock for immediate delivery to you.

WRITE FOR CATALOG 50 & PRICE LIST

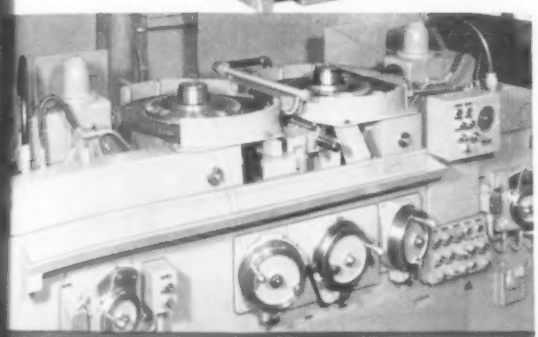
BALAS COLLET MANUFACTURING CO.
1560 EAST 27th STREET CLEVELAND 14, OHIO

WORLD'S LARGEST MANUFACTURER OF COLLETS EXCLUSIVELY

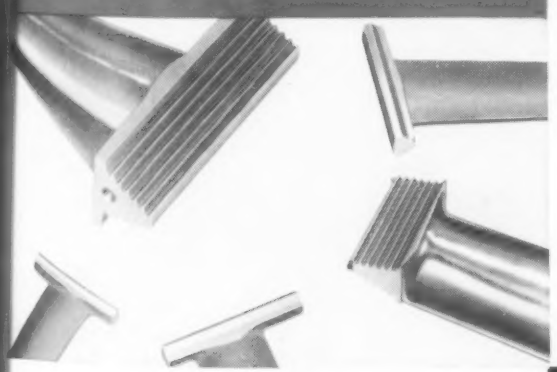
Production-Proved

EX-CELL-O Machine Grinds Jet Blade Roots

Ex-Cell-O Style 85 Precision Two-Wheel Form Grinder for grinding [illegible] forms of jet engine blades.



The machine uses two wheels to grind both sides of the root form simultaneously.



Dovetail and pinetree forms, in various sizes, are ground from rough forgings.

PRECISION TWO-WHEEL FORM GRINDER GIVES FINE FINISH, HIGH PRODUCTION

This production-proved Ex-Cell-O Precision Two-Wheel Form Grinder finishes roots of jet engine blades with speed, economy and precision. It is fully automatic except for loading, unloading and pushbutton starting.

Two 24-inch diamond-dressed grinding wheels are used, the work reciprocating between them. Dovetail or pinetree forms of various sizes can be ground economically from semi-finished and rough forgings. Work reciprocation, wheel feed to finish size, coolant control, unclamping, wheel retraction, and wheel dressing are all done in an automatic cycle.

Controls are so simple that unskilled operators can do this high precision work. For more information and complete specifications contact Ex-Cell-O in Detroit.

XLO
EX-CELL-O for PRECISION

EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • CUTTING TOOLS
RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT
AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

Lowest Cost Way TO DE-BURIZE up to 300 Gear Teeth per minute

MODEL NO. 380-A

Cut finished gear costs and raise output at the same time—with Sheffield #380 Series Gear Deburizers which offer the following advantages.

★ Burr or chamfer spur, helical, hypoid, bevel and herringbone gears, also, multiple start worms, up to 7" O.D. (Model #381 will handle gears from 6" to 12" O.D.)

★ Operate on automatic or continuous cycle generally without clamping the work gear.

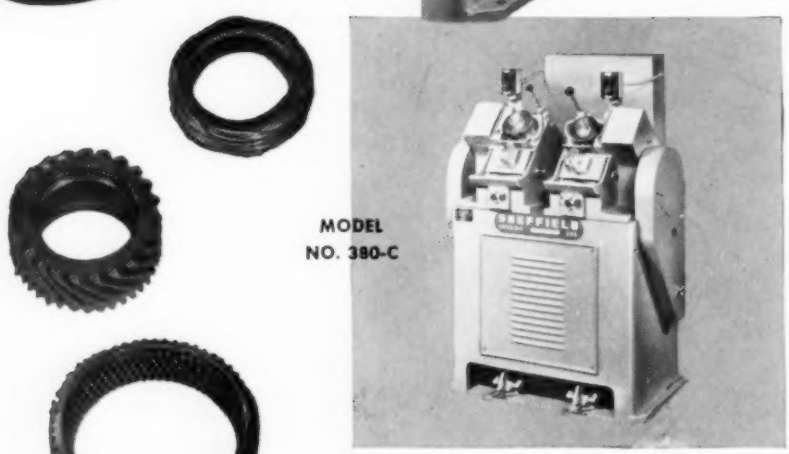
★ Use simple, low cost standard tool bits which are easily sharpened on the face angle only.

★ Interchangeability of tooling with minimum down time.

★ Small, compact, low cost machine requires minimum of setup and changeover time—and practically no maintenance.

★ Direct drive assures positive indexing.

Write for specifications #B-380-50 —or call your Sheffield Representative.



MODEL NO. 380-C

5665

SHEFFIELD MASTER CRAFTSMEN HEADQUARTERS

the Sheffield corporation
Dayton 1, Ohio, U. S. A.

GAGES • MEASURING INSTRUMENTS • MACHINE TOOLS • CONTRACT SERVICES • INSTRUM...

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-10-182

UBLICATI

NOVE

VOLU